



Ladder Communication Modules

IM 34M6H22-02E

Applicable Modules:

| Model Code | Model Name |
|------------|-----------------------------|
| F3RZ81-0F | Ladder Communication Module |
| F3RZ82-0F | Ladder Communication Module |
| F3RZ91-0F | Ladder Communication Module |

Applicable Product

● Range-free Multi-controller FA-M3

Model code : F3RZ81-0F, F3RZ82-0F, F3RZ91-0F

Name : Ladder Communication Module

The document number and document model code for this manual are given below.

Refer to the document number in all communications; also refer to the document number and the document model code when purchasing additional copies of this manual.

Document No. : IM 34M6H22-02E

Document Model Code : DOCIM

Important

■ About This Manual

- This Manual should be passed on to the end user.
- Before using the controller, read this manual thoroughly to have a clear understanding of the controller.
- This manual explains the functions of this product, but there is no guarantee that they will suit the particular purpose of the user.
- Under absolutely no circumstances may the contents of this manual be transcribed or copied, in part or in whole, without permission.
- The contents of this manual are subject to change without prior notice.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, should any errors or omissions come to the attention of the user, please contact the nearest Yokogawa Electric representative or sales office.

■ Safety Precautions when Using/Maintaining the Product

The following safety symbols are used on the product as well as in this manual.



Danger. This symbol on the product indicates that the operator must follow the instructions laid out in this instruction manual to avoid the risk of personnel injuries, fatalities, or damage to the instrument. Where indicated by this symbol, the manual describes what special care the operator must exercise to prevent electrical shock or other dangers that may result in injury or the loss of life.



Protective Ground Terminal. Before using the instrument, be sure to ground this terminal.



Function Ground Terminal. Before using the instrument, be sure to ground this terminal.



Alternating current. Indicates alternating current.



Direct current. Indicates direct current.

The following symbols are used only in the instruction manual.

**WARNING**

Indicates a “Warning”.

Draws attention to information essential to prevent hardware damage, software damage or system failure.

**CAUTION**

Indicates a “Caution”

Draws attention to information essential to the understanding of operation and functions.

TIP

Indicates a “TIP”

Gives information that complements the present topic.

SEE ALSO

Indicates a “SEE ALSO” reference.

Identifies a source to which to refer.

- For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety stated in this manual whenever handling the product. Take special note that if you handle the product in a manner other than prescribed in these instructions, the protection feature of the product may be damaged or impaired. In such cases, Yokogawa cannot guarantee the quality, performance, function and safety of the product.
- When installing protection and/or safety circuits such as lightning protection devices and equipment for the product and control system as well as designing or installing separate protection and/or safety circuits for fool-proof design and fail-safe design of processes and lines using the product and the system controlled by it, the user should implement it using devices and equipment, additional to this product.
- If component parts or consumable are to be replaced, be sure to use parts specified by the company.
- This product is not designed or manufactured to be used in critical applications which directly affect or threaten human lives and safety — such as nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities or medical equipment. If so used, it is the user's responsibility to include in the system additional equipment and devices that ensure personnel safety.
- Do not attempt to modify the product.

■ Exemption from Responsibility

- Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa Electric) makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.
- Yokogawa Electric assumes no liability to any party for any loss or damage, direct or indirect, caused by the use or any unpredictable defect of the product.

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- Yokogawa Electric makes no other warranties expressed or implied except as provided in its warranty clause for software supplied by the company.
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- Reverse engineering, such as decompiling of the software, is strictly prohibited.
- No portion of the software supplied by Yokogawa Electric may be transferred, exchanged, or sublet or leased for use by any third party without prior permission by Yokogawa Electric.

■ General Requirements for Using the FA-M3 Controller

● Avoid installing the FA-M3 controller in the following locations:

- Where the instrument will be exposed to direct sunlight, or where the operating temperature exceeds the range 0°C to 55°C (32°F to 131°F).
- Where the relative humidity is outside the range 10 to 90%, or where sudden temperature changes may occur and cause condensation.
- Where corrosive or flammable gases are present.
- Where the instrument will be exposed to direct mechanical vibration or shock.
- Where the instrument may be exposed to extreme levels of radioactivity.

● Use the correct types of wire for external wiring:

- Use copper wire with temperature ratings greater than 75°C.

● Securely tighten screws:

- Securely tighten module mounting screws and terminal screws to avoid problems such as faulty operation.
- Tighten terminal block screws with the correct tightening torque as given in this manual.

● Securely lock connecting cables:

- Securely lock the connectors of cables, and check them thoroughly before turning on the power.

● Interlock with emergency-stop circuitry using external relays:

- Equipment incorporating the FA-M3 controller must be furnished with emergency-stop circuitry that uses external relays. This circuitry should be set up to interlock correctly with controller status (stop/run).

● Ground for low impedance:

- For safety reasons, connect the [FG] grounding terminal to a Japanese Industrial Standards (JIS) Class D (earlier called Class 3) Ground^{*1}. For compliance to CE Marking, use braided or other wires that can ensure low impedance even at high frequencies for grounding.

^{*1} Japanese Industrial Standard (JIS) Class D Ground means grounding resistance of 100 Ω max.

● Configure and route cables with noise control considerations:

- Perform installation and wiring that segregates system parts that may likely become noise sources and system parts that are susceptible to noise. Segregation can be achieved by measures such as segregating by distance, installing a filter or segregating the grounding system.

● Configure for CE Marking Conformance:

- For compliance to CE Marking, perform installation and cable routing according to the description on compliance to CE Marking in the "Hardware Manual" (IM34M6C11-01E).

● **Keep spare parts on hand:**

- Stock up on maintenance parts including spare modules, in advance.

● **Discharge static electricity before operating the system:**

- Because static charge can accumulate in dry conditions, first touch grounded metal to discharge any static electricity before touching the system.

● **Never use solvents such as paint thinner for cleaning:**

- Gently clean the surfaces of the FA-M3 controller with a cloth that has been soaked in water or a neutral detergent and wringed.
- Do not use volatile solvents such as benzine or paint thinner or chemicals for cleaning, as they may cause deformity, discoloration, or malfunctioning.

● **Avoid storing the FA-M3 controller in places with high temperature or humidity:**

- Since the CPU module has a built-in battery, avoid storage in places with high temperature or humidity.
- Since the service life of the battery is drastically reduced by exposure to high temperatures, take special care (storage temperature should be from -20°C to 75°C).
- There is a built-in lithium battery in a CPU module and temperature control module which serves as backup power supply for programs, device information and configuration information. The service life of this battery is more than 10 years in standby mode at room temperature. Take note that the service life of the battery may be shortened when installed or stored at locations of extreme low or high temperatures. Therefore, we recommend that modules with built-in batteries be stored at room temperature.

● **Always turn off the power before installing or removing modules:**

- Failing to turn off the power supply when installing or removing modules, may result in damage.

● **Do not touch components in the module:**

- In some modules you can remove the right-side cover and install ROM packs or change switch settings. While doing this, do not touch any components on the printed-circuit board, otherwise components may be damaged and modules may fail to work.

● **Do not use unused terminals:**

- Do not connect wires to unused terminals on a terminal block or in a connector. Doing so may adversely affect the functions of the module.

■ Waste Electrical and Electronic Equipment



Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC

(This directive is only valid in the EU.)



This product complies with the WEEE Directive (2002/96/EC) marking requirement. The following marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category

With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a "Monitoring and Control instrumentation" product.

Do not dispose in domestic household waste.

When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

Introduction

■ Overview of the Manual

This manual describes the specifications, operations, and communications protocol of the ladder communication modules F3RZ81-0F, F3RZ82-0F, and F3RZ91-0F.

■ Related Instruction Manuals

Read the relevant manuals depending on the sequence CPU module type used:

- **For information on the functions of the F3SP66 or F3SP67 sequence CPU modules, refer to:**
 - Sequence CPU – Functions User's Manual (for F3SP66-4S, F3SP67-6S) (IM34M6P14-01E)
 - Sequence CPU – Network Functions User's Manual (for F3SP66-4S, F3SP67-6S) (IM34M6P14-02E)
- **For information on the functions of the F3SP28, F3SP38, F3SP53, F3SP58, or F3SP59 sequence CPU modules, refer to:**
 - Sequence CPU – Functions User's Manual (for F3SP28-3N/3S, F3SP38-6N/6S, F3SP53-4H/4S, F3SP58-6H/6S, F3SP59-7S) (IM34M6P13-01E)
- **For information on the functions of the F3SP21, F3SP25, F3SP35, F3SP05, or F3SP08 sequence CPU modules, refer to:**
 - Sequence CPU – Functions User's Manual (for F3SP21, F3SP25, and F3SP35) (IM34M6P12-02E)
- **For information on the instructions used with sequence CPUs, refer to:**
 - Sequence CPU – Instructions User's Manual (IM34M6P12-03E)
- **When creating programs using ladder language, refer to:**
 - FA-M3 Programming Tool WideField2 User's Manual (IM34M6Q15-01E)
- **For information on the specifications*, configuration*, installation, wiring, trial operation, maintenance and inspection of the FA-M3, as well as information on the system-wide limitation of module installation, refer to:**
 - Hardware Manual (IM34M6C11-01E).

*: For information on the specifications of products other than the power supply module, base module, I/O module, cable and terminal block unit, refer to their respective user's manuals.

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FA-M3**Ladder Communication Module****Part A: F3RZ81-0F/F3RZ82-0F**

IM 34M6H22-02E 2nd Edition

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A1. Overview

The Ladder Communication module can be used with an FA-M3 CPU module for RS-232-C communications. The F3RZ81-0F has one and the F3RZ82-0F has two D-sub 9-pin connectors, or ports, which support a maximum transmission distance of 15 m. Each port operates independently and a communications error at one port does not affect the operation of the other port.

Any input relay of the Ladder Communication module may be used to raise an interrupt.

Table A1.1 Models of Ladder Communication Module

| Model | Description |
|-----------|---|
| F3RZ81-0F | RS-232-C ladder communication module, one port |
| F3RZ82-0F | RS-232-C ladder communication module, two ports |

A2. Specifications

A2.1 Standard Specifications

■ Model and Suffix Codes

| Model | Suffix Code | Style Code | Option Code | Description |
|--------|-------------|------------|-------------|------------------------------------|
| F3RZ81 | -0F | | | Max 115.2 kbps, one RS-232-C port |
| F3RZ82 | -0F | | | Max 115.2 kbps, two RS-232-C ports |

■ Operating Environment

The F3RZ81-0F and F3RZ82-0F may be used with all CPU modules.

■ General Specifications

| Item | Specifications | Item | Specifications |
|-----------------------|---|---------------------|-------------------------------|
| Operating temperature | 0 to 55°C | Storage temperature | -20 to 75°C |
| Operating humidity | 10 to 90% RH (non-condensing) | Storage humidity | 10 to 90% RH (non-condensing) |
| Operating environment | Must of free of corrosive gases, flammable gases and heavy dust | | |

■ Physical Specifications

| Item | Specifications | Item | Specifications |
|-----------------------|--|---------------------|--------------------------------------|
| Interface | EIA RS-232-C compliant | Current consumption | F3RZ81-0F 320 mA F3RZ82-0F 350 mA |
| Number of ports | F3RZ81-0F 1 (not isolated) F3RZ82-0F 2 (not isolated) | External dimensions | 28.9 (W) x 100 (H) x 83.2 (D) mm* |
| Transmission distance | 15 m max. | Weight | F3RZ81-0F 120 g F3RZ82-0F 120 g |
| Connector | D-Sub 9-pin (female), M2.6 (mm) | | |

*: Dimensions excluding protrusions. For details, see the External Dimensions drawing.

■ Function Specifications

| Item | Specifications | Default |
|-------------------------|---|--|
| Connection method | Point to point | — |
| Transmission mode | Full-duplex/half-duplex | — |
| Synchronization | Start-stop synchronization | — |
| Communication protocol | No protocol | — |
| Data format | Character length | 7 or 8 bits *1 (see next page) |
| | Stop bits | 1 or 2 bits *1 (see next page) |
| | Parity bit | None, even or odd *1 (see next page) |
| Transmission speed | 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, or 115200 bps | *2 |
| Control lines | RS control | (1) Always on. (2) Turn on before sending. (1) |
| | DR check | (1) Ignore DR when sending. (2) Send only when DR is on. (1) |
| | CD check | (1) Ignore CD when sending. (2) Send only when CD is off. (1) |
| | ER control | (1) On (ready) (2) Off (not ready) (1) |
| Communication buffer | Send buffer | Text buffer (3584 bytes max.) ³ — |
| | Receive buffer | 8192-byte rotary buffer (FIFO buffer) — |
| Format of received text | Start character | - Yes or no - Any single character No |
| | End character (terminator) | - Yes or no - Up to 2 characters long, any characters - Also used as send terminator. \$0D and \$0A (CR-LF) |

| Item | | Specifications | Default |
|--------------------------------|---|--|------------------|
| Format of received text | Text length | Can be specified as any number between 1 and 3584 ^{*3} . | 1024 |
| | Character-to-character timeout interval | 0 to 32760 ms in 1 ms increments, accurate to 1 ms (0 means not monitored) | 1.5 s |
| Clear-to-send timeout interval | | 0 to 32760 ms in 1 ms increments, accurate to 1 ms (0 means not monitored) | Monitored (30 s) |
| Break transmission interval | | 1 to 32760 ms in 1 ms increments, accurate to 1 ms | 400 ms |

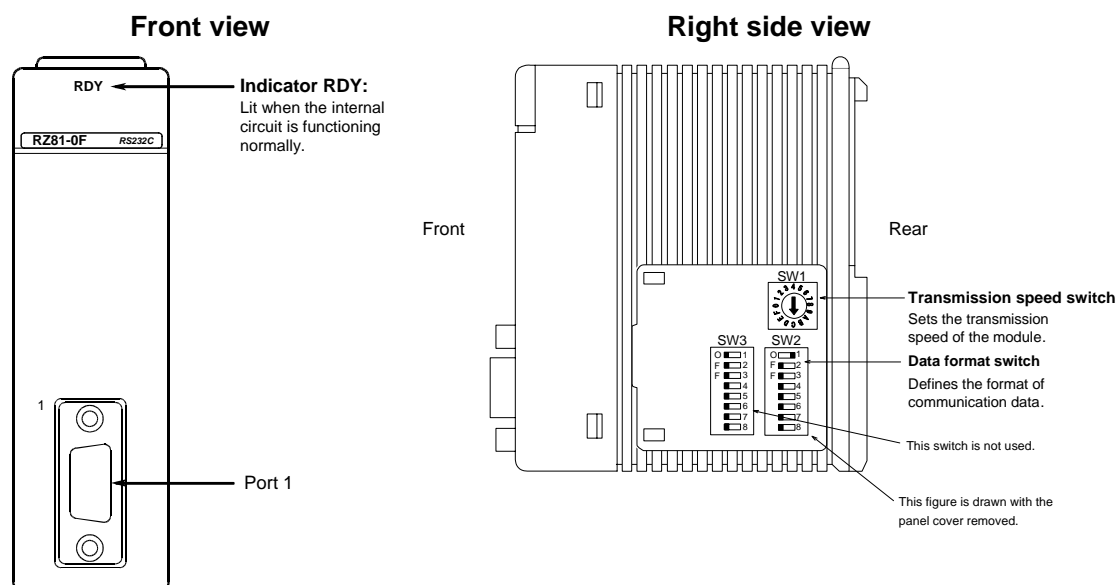
*1: Default values are set with the data format switch (SW2).

*2: Default values are set with the transmission speed switch (SW1).

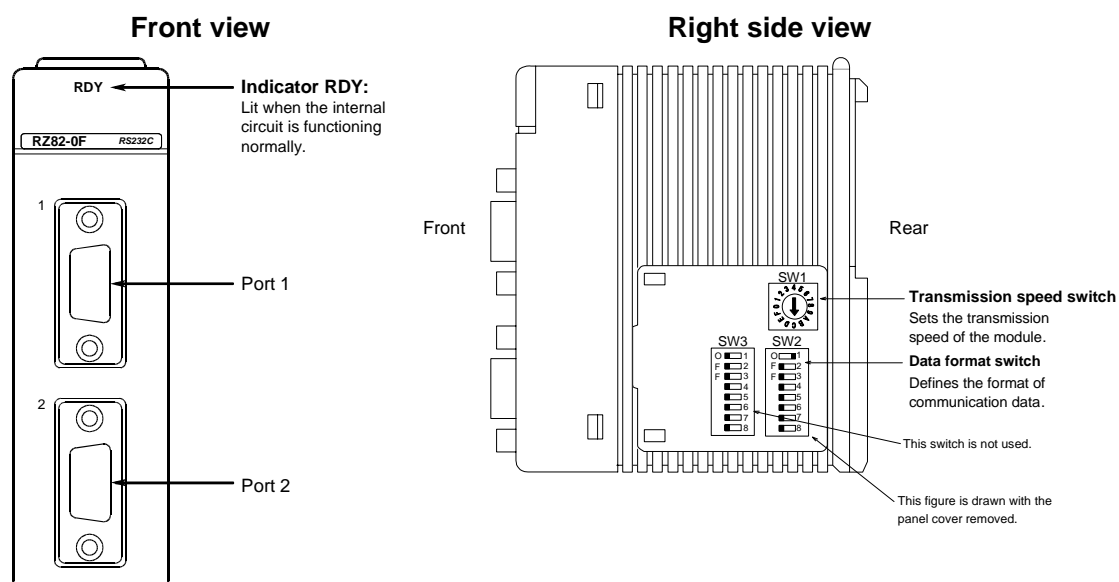
*3: The send/receive data register size can be changed to accommodate up to 3584 bytes.

■ Components and Functions

● F3RZ81-0F



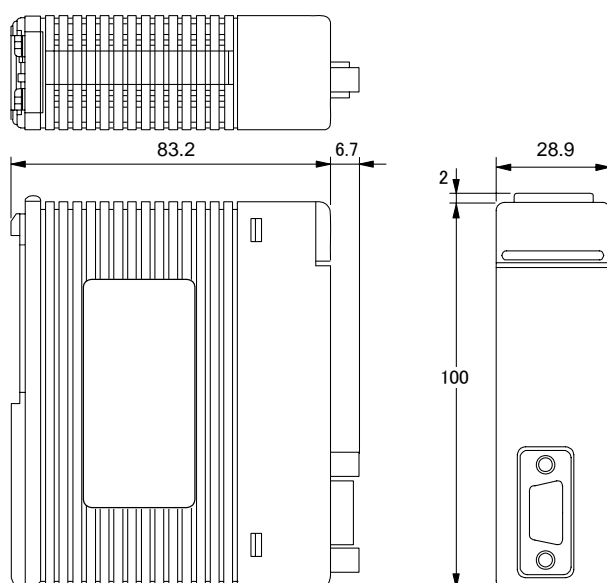
● F3RZ82-0F



■ External Dimensions

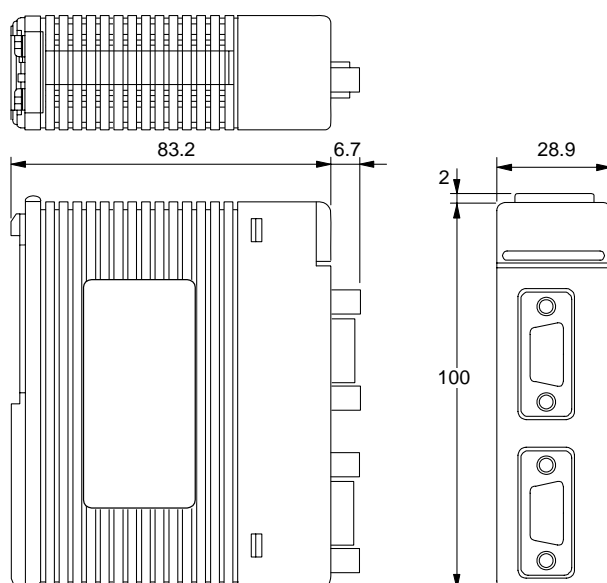
● F3RZ81-0F

(Unit: mm)



● F3RZ82-0F

(Unit: mm)



Note: This module requires a minimal mounting depth of 173 (83 + 90) mm so that it can be comfortably installed on the base module and attached with an external RS-232-C connector and cable, with adequate space to accommodate the bending radius of the cable.

A2.2 Switch Setup

■ Switches on the Module

Always set the three switches on the side of the F3RZ81-0F/F3RZ82-0F module before installing it on the FA-M3 base module. See Figure A2.1 for the switch names and locations.

● Right side view (F3RZ82-0F)

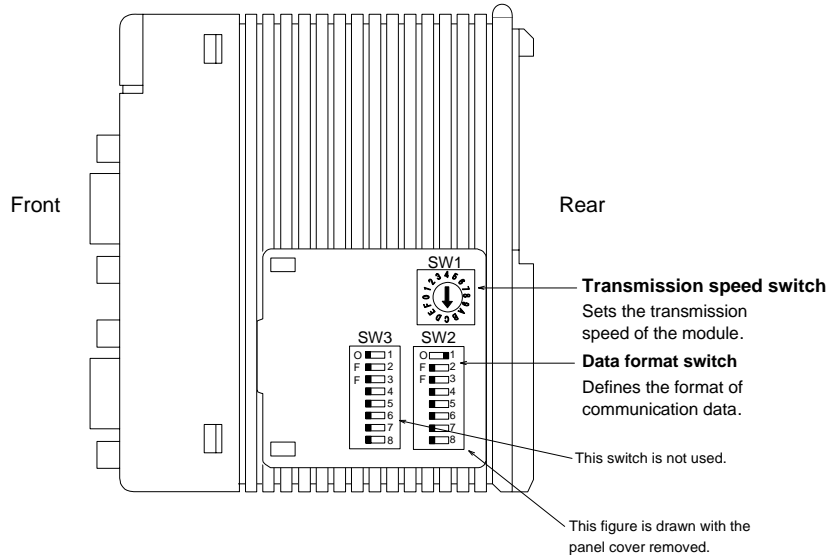
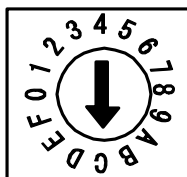


Figure A2.1 F3RZ81-0F/F3RZ82-0F Switches

● Transmission speed switch (SW1)

This is a hexadecimal rotary switch for setting up the transmission speed of the module. You can set the switch by inserting a small flat-blade screwdriver in its arrow-shaped slit and rotating it to a desired position between 1 and C (positions D to F are not available). The factory setting is 'C' (= 115.2 kbps).



| SW1 Position | Transmission speed (bps) | Remarks |
|--------------|--------------------------|-----------------|
| 0 | 300 | |
| 1 | 600 | |
| 2 | 1200 | |
| 3 | 2400 | |
| 4 | 4800 | |
| 5 | 9600 | |
| 6 | 14400 | |
| 7 | 19200 | |
| 8 | 22800 | |
| 9 | 38400 | |
| A | 57.6K | |
| B | 76.8K | |
| C | 115.2K | Factory setting |
| D-F | ----- | Not available |

- The setting with SW1 applies to both port 1 and port 2.
- The SW1 setting may be changed by software for an individual port.

Figure A2.2 F3RZ81-0F/F3RZ82-0F Transmission speed Switch

● Data format switch (SW2)

This is an 8-element DIP switch for defining a character frame. Elements 1-4 may be set to either the ON or OFF position to define character length, parity and stop bits. The factory setting has element 1 set to ON and elements 2-8 set to OFF.

| | | | | | | |
|--|--------------|------------------|--------|--------|-----------|-----|
| | SW2 Elements | Function | OFF | ON | Default | |
| | 1 | Character length | 7 bits | 8 bits | 8 bits | ON |
| | 2 | Parity | No | Yes | No parity | OFF |
| | 3 | | Odd | Even | ---- | OFF |
| | 4 | Stop bits | 1 bit | 2 bits | 1 bit | OFF |
| | 5 | Not used | ---- | ---- | ---- | OFF |
| | 6 | Not used | ---- | ---- | ---- | OFF |
| | 7 | Not used | ---- | ---- | ---- | OFF |
| | 8 | Not used | ---- | ---- | ---- | OFF |

- The SW2 setting applies to both port 1 and port 2.
- The SW2 setting may be changed by software for an individual port.
- SW2-3 is available only when SW2-2 is set to ON (= using parity).
- Always set SW2-5 to SW2-8 to OFF.

Figure A2.3 F3RZ81-0F/F3RZ82-0F Data Format Switch

● Reserved switch (SW3)

The F3RZ81-0F/F3RZ82-0F does not use the SW3 switch. The module must be used with all elements of this switch set to OFF (factory setting).

| | | | | | | |
|--|--------------|----------|-----|----|---------|-----|
| | SW3 Elements | Function | OFF | ON | Default | |
| | 1 | Not used | | | | OFF |
| | 2 | Not used | | | | OFF |
| | 3 | Not used | | | | OFF |
| | 4 | Not used | | | | OFF |
| | 5 | Not used | | | | OFF |
| | 6 | Not used | | | | OFF |
| | 7 | Not used | | | | OFF |
| | 8 | Not used | | | | OFF |

Figure A2.4 F3RZ81-0F/F3RZ82-0F Reserved Switch



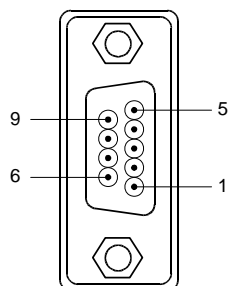
CAUTION

Ensure that all unused switch elements are set to OFF.

A2.3 External Wiring

■ Connector Pin Assignment

Front view of the connector on the module

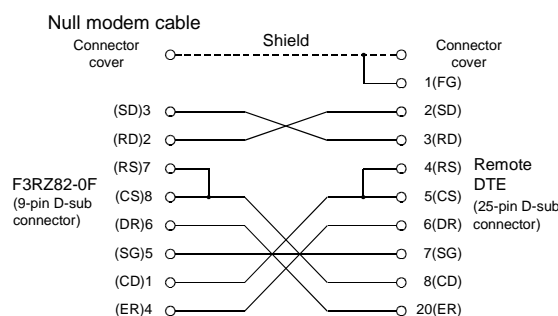


9-pin D-sub connector (female)

| Pin No. | Symbol | Signal | Direction | | Signal Monitored | Description |
|---------|--------|---------------------|-----------|--------|------------------|--|
| | | | FA-M3 | Remote | | |
| 1 | CD | Data carrier detect | ← | | Yes | The module receives data only when this signal is on and sends data as follows: (1) Ignore CD when sending (default), or (2) Send only when CD is off. |
| 2 | RD | Receive data | ← | | No | |
| 3 | SD | Send data | → | | No | |
| 4 | ER | Data terminal ready | → | | No | (1) On when powered (default), or (2) On or off by software. |
| 5 | SG | Signal ground | ↔ | | No | |
| 6 | DR | Data set ready | ← | | Yes | Used to check whether the remote station is ready to receive data. (1) Ignore DR when sending (default), or (2) Send only when DR is on. |
| 7 | RS | Request to send | → | | No | Used when sending data to the remote station. (1) Always on (default), or (2) Turn on before sending data. |
| 8 | CS | Clear to send | ← | | Yes | Clear-to-send signal from a remote device. The module can send data only when this signal is on. |
| 9 | – | Not used | – | | No | |

*: Option (1) or (2) can be selected using a program.

■ Directly Connecting to an RS-232-C Device, or DTE (data terminal equipment)



*: Pin numbers of the connector of the remote DTE shown in this diagram assumes a 25-pin D-sub connector. An example of such a cable is YOKOGAWA's YCB cable.

Figure A2.5 Wiring to 25-pin D-sub Connector

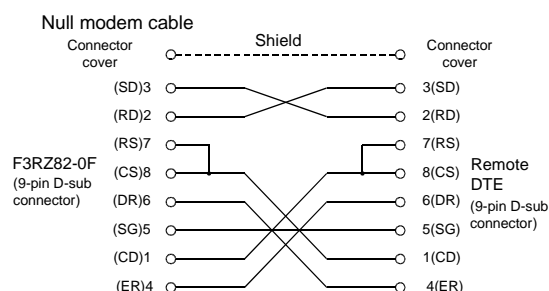


Figure A2.6 Wiring to 9-pin D-sub Connector

● How to treat the shield

1. Ensure that the connector for the connection cable has a metal or metal-clad cover. Connect the shield directly to the cover.
2. The connector shell of the F3RZ81-0F/F3RZ82-0F is internally connected to the Frame Ground terminal (FG) of the FA-M3 power supply module.

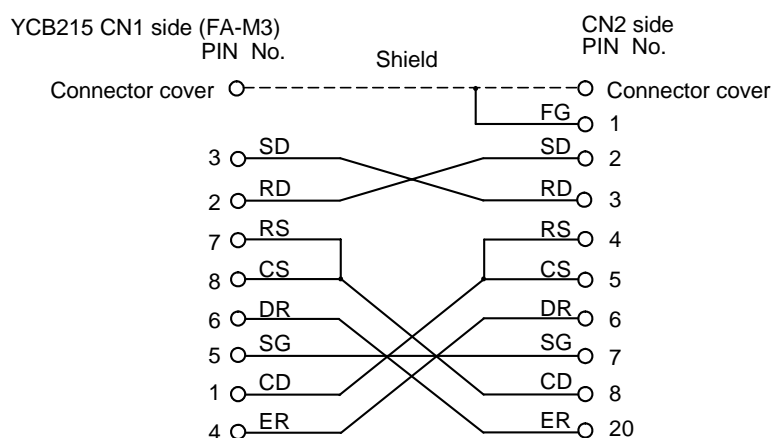
● Recommended connection cable

YOKOGAWA's null-modem cable is recommended for this purpose.

| Model Name | Suffix Code | Description |
|------------|-------------|---|
| YCB215 | | RS-232-C null-modem cable with control lines between 9-pin connector (on CP7□ ML gateway card) and 25-pin connector (on RS-232-C equipment) |
| | -KM01 | 1 m cable |
| | -KM05 | 5 m cable |
| | -KM15 | 15 m cable |

Note: This cable is for indoor use only. The wires are termination-treated.

● Internal connection diagram for YCB215 cable



■ Connecting to a Modem, or DCE (data communications equipment)

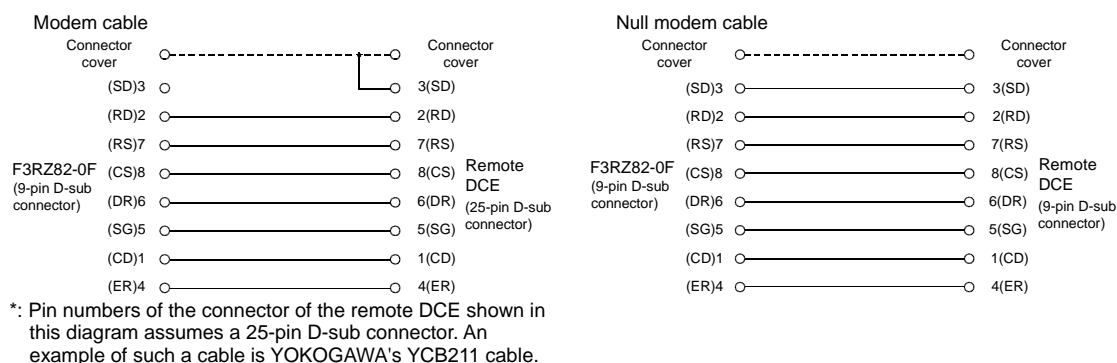


Figure A2.7 Wiring to 25-pin D-sub Connector

Figure A2.8 Wiring to 9-pin D-sub Connector

● How to treat the shield

1. Ensure that the connector for the connection cable has a metal or metal-clad cover. Connect the shield directly to the cover.
2. The connector shell of the F3RZ81-0F/F3RZ82-0F is internally connected to the Frame Ground terminal (FG) of the FA-M3 power supply module.

● Recommended connection cable

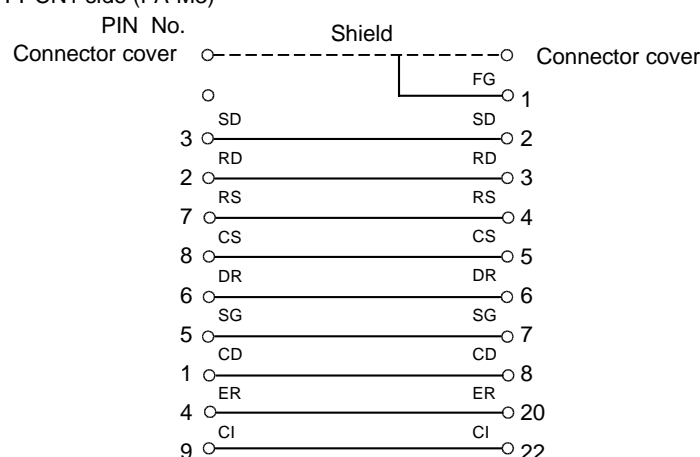
YOKOGAWA's modem cable is recommended for this purpose

| Model Name | Suffix Code | Description |
|------------|-------------|--|
| YCB211 | | RS-232-C modem cable between 9-pin connector (on CP7□ ML gateway card) and 25-pin connector (on modem) |
| | -KM01 | 1-m cable |
| | -KM05 | 5-m cable |
| | -KM15 | 15-m cable |

Note: This cable is for indoor use only. The wires are termination-treated.

● Internal connection diagram for YCB211 cable

YCB211 CN1 side (FA-M3)



A2.4 Attaching/Detaching the Module

■ Attaching the Module

Figure A2.9 shows how to attach this module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module. Push the top of the module toward the base module until the anchor/release button (yellow button) clicks into place.



CAUTION

Always switch off the power before attaching or detaching the module.

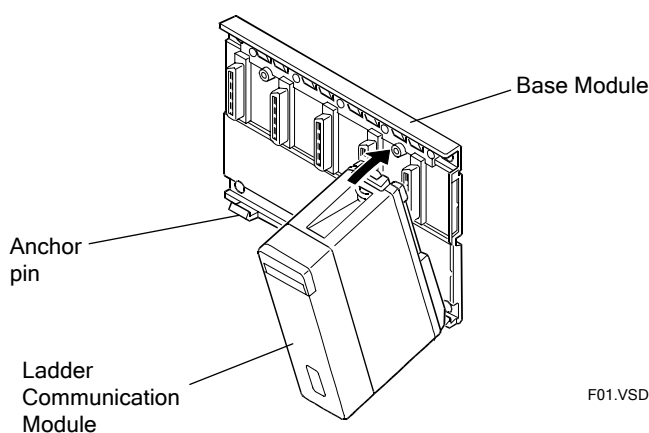


Figure A2.9 Attaching/Detaching the Module



CAUTION

Do not bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend, causing an error.

■ Detaching the Module

To remove this module from the base module, reverse the above operation.

Press the anchor/release button (yellow button) on the top of this module to unlock it and tilt the module away from the base module.

■ Attaching the Module in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw. Use screws of type listed in the table below.

Insert these screws into the screw holes on top of the module and tighten them with a Phillips screwdriver.

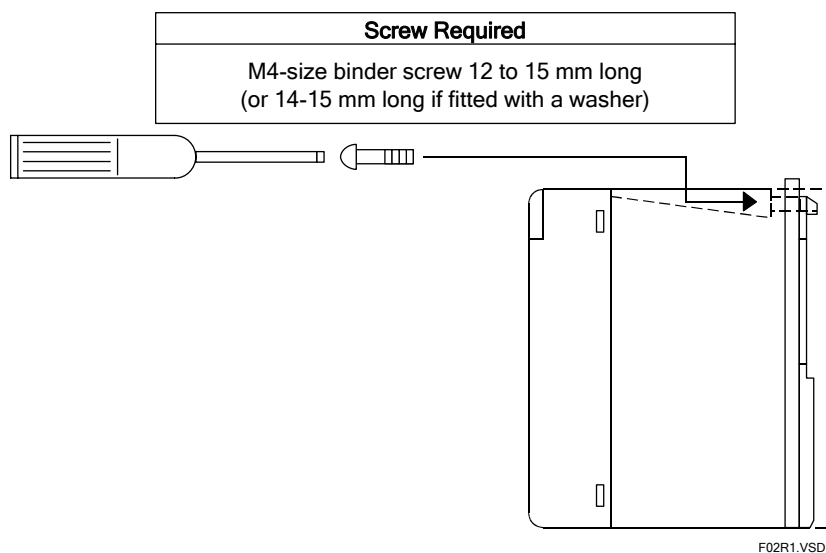


Figure A2.10 Securing Module Using Screws

A3. List of I/O Relays

The ladder communication module has 32 input and 32 output relays for interfacing with the FA-M3 CPU module. Each of the input relays can be configured to raise an interrupt.

A3.1 Output Relays

Table A3.1 Output Relays

| Output Relay Number | Output Relay Name | Description |
|---------------------|--|---|
| Y□□□33 | Read Received Data Completed ^{*1} | Turn on this relay after reading data from the receive data area. Turning on this relay turns off X□□□01 (receive completed normally) and X□□□07 (receive error), and the module is ready to receive new data into the receive data area. |
| Y□□□34 | Request to Send ^{*1} | Turn on this relay after having stored send data size and send data to the registers. If data is sent successfully following this request, X□□□02 turns on, and if an error occurs, X□□□08 turns on. |
| Y□□□35 | Request to Set Communications Mode ^{*1} | Turn on this relay after having stored communications mode setting in the communications mode area. If setup is successful following this request, X□□□03 turns on, and if an error occurs, X□□□09 turns on. |
| Y□□□36 | Request to Read Communications Mode Status ^{*1} | Turn on this relay to read the contents of the communications mode area and the control line status. If the request is completed successfully, X□□□04 turns on. |
| Y□□□37 | Request to Initialize Receive Buffer ^{*1} | Turn on this relay to initialize the receive buffer and the communications controller. X□□□05 turns on after successful initialization. |
| Y□□□38 | Request to Send Break ^{*1} | Turn on this relay to send a break signal. If a break is sent successfully following this request, X□□□06 turns on, and if an error occurs, X□□□08 turns on. |
| Y□□□39 to Y□□□48 | Reserved | |
| Y□□□49 | Read Received Data Completed ^{*2} | Turn on this relay after having read all data from the receive data area. Turning on this relay turns off X□□□17 (receive completed normally) and X□□□23 (receive error), and the module is ready to receive new data in the receive data area. |
| Y□□□50 | Request to Send ^{*2} | Turn on this relay after having stored send data size and send data to the registers. If data is sent successfully following this request, X□□□18 turns on, and if an error occurs, X□□□24 turns on. |
| Y□□□51 | Request to Set Communications Mode ^{*2} | Turn on this relay after having stored communications mode setting in the communications mode area. If setup is successful following this request, X□□□19 turns on, and if an error occurs, X□□□25 turns on. |
| Y□□□52 | Request to Read Communications Mode Status ^{*2} | Turn on this relay to read the contents of the communications mode area and the control line status. If the request is completed successfully, X□□□20 is turns on. |
| Y□□□53 | Request to Initialize Receive Buffer ^{*2} | Turn on this relay to initialize the receive buffer and the communications controller. X□□□21 turns on after successful initialization. |
| Y□□□54 | Request to Send Break ^{*2} | Turn on this relay to send a break signal. If a break is sent successfully following this request, X□□□22 turns on, and if an error occurs, X□□□24 turns on. |
| Y□□□55 to Y□□□64 | Reserved | |

*1 : Applies to F3RZ81-0F or port 1 of F3RZ82-0F.

*2 : Applies to port 2 of F3RZ82-0F only. Reserved for system use in F3RZ81-0F.

□□□ : Slot number

A3.2 Input Relays

Table A3.2 Input Relays

| Input Relay Number | Input Relay Name | Description |
|--------------------|---|---|
| X□□□01 | Receive Completed ^{*1} | This relay turns on when received data is transferred from the receive buffer to the receive data area. Turning on Y□□□33 turns off this relay. |
| X□□□02 | Send Completed ^{*1} | This relay turns on when data is successfully sent following a request to send. Turning off Y□□□34 turns off this relay. |
| X□□□03 | Set Communications Mode Completed ^{*1} | This relay turns on when a request to set communications mode is successfully completed. Turning off Y□□□35 turns off this relay. |
| X□□□04 | Read Communications Mode Status Completed ^{*1} | This relay turns on when the communications mode status has been successfully read out and stored. Turning off Y□□□36 turns off this relay. |
| X□□□05 | Initialize Receive Buffer Completed ^{*1} | This relay turns on when the receive buffer and the communications controller have been successfully initialized. Turning off Y□□□37 turns off this relay. |
| X□□□06 | Send Break Completed ^{*1} | This relay turns on when a break signal has been sent successfully. Turning off Y□□□38 turns off this relay. |
| X□□□07 | Receive Error ^{*1} | This relay turns on if error is detected during data receiving. Turning on Y□□□33 turns off this relay. |
| X□□□08 | Send Error ^{*1} | This relay turns on if error is detected when processing a request to send or a request to send break. Turning off Y□□□34 or Y□□□38 turns off this relay. |
| X□□□09 | Set Communications Mode Error ^{*1} | This relay turns on if error is detected during communications mode setup. Turning off Y□□□35 turns off this relay. |
| X□□□10 to X□□□16 | Reserved | |
| X□□□17 | Receive Completed ^{*2} | This relay turns on when received data is transferred from the receive buffer to the receive data area. Turning on Y□□□49 turns off this relay. |
| X□□□18 | Send Completed ^{*2} | This relay turns on when data is successfully sent following a request to send. Turning off Y□□□50 turns off this relay. |
| X□□□19 | Set Communications Mode Completed ^{*2} | This relay turns on when a request to set communications mode is successfully completed. Turning off Y□□□51 turns off this relay. |
| X□□□20 | Read Communications Mode Status Completed ^{*2} | This relay turns on when the communications mode status has been successfully read out and stored. Turning off Y□□□52 turns off this relay. |
| X□□□21 | Initialize Receive Buffer Completed ^{*2} | This relay turns on when the receive buffer and the communications controller have been successfully initialized. Turning off Y□□□53 turns off this relay. |
| X□□□22 | Send Break Completed ^{*2} | This relay turns on when a break signal has been sent successfully. Turning off Y□□□54 turns off this relay. |
| X□□□23 | Receive Error ^{*2} | This relay turns on if error is detected during data receiving. Turning on Y□□□49 turns off this relay. |
| X□□□24 | Send Error ^{*2} | This relay turns on if error is detected when processing a request to send or a request to send break. Turning off Y□□□50 or Y□□□54 turns off this relay. |
| X□□□25 | Set Communications Mode Error ^{*2} | This relay turns on if error is detected during communications mode setup. Turning off Y□□□51 turns off this relay. |
| X□□□26 to X□□□32 | Reserved | |

*1 : Applies to F3RZ81-0F or port 1 of F3RZ82-0F.

*2 : Applies to port 2 of F3RZ82 only. Reserved for system use in F3RZ81-0F.

□□□ : Slot number

A4. List of Data Areas

The ladder communication module has send and receive data areas and communications mode areas for interfacing with the FA-M3 CPU module. The communications mode areas are used to store communications mode settings, and the send and receive data areas are used to store data to be sent and data received respectively.

| Data Position No. | F3RZ81-0F | Data Position No. | F3RZ82-0F |
|-------------------|-----------------------------------|-------------------|-----------------------------------|
| 1 | Send data area (port 1) | 1 | Send data area (port 1) |
| 384 | | 384 | |
| 385 | Receive data area (port 1) | 385 | Receive data area (port 1) |
| 896 | | 896 | |
| 897 | Extended send/receive data area | 897 | Send data area (port 2) |
| 1792 | | 1280 | |
| 1793 | | 1281 | Receive data area (port 2) |
| 1794 | | 1792 | |
| 1795 | | 1793 | Send data byte count (port 1) |
| 1796 | Send data byte count (port 1) | 1794 | Send status (port 1) |
| 1797 | Send status (port 1) | 1795 | Receive data status (port 1) |
| 1798 | Receive data status (port 1) | 1796 | Receive data byte count (port 1) |
| 1799 | Receive data byte count (port 1) | 1797 | Send data byte count (port 2) |
| 1800 | Reserved | 1798 | Send status (part 2) |
| 1857 | Reserved | 1799 | Receive data status (port 2) |
| 1920 | Reserved | 1800 | Receive data byte count (port 2) |
| 1921 | Reserved | 1857 | Communications mode area (port 1) |
| 1984 | Communications mode area (port 1) | 1920 | |
| | | 1921 | Communications mode area (port 2) |
| | | 1984 | |



CAUTION

- You may customize the send data area size and receive data area size to use data positions between 1 and 1792.
- Data positions above 1792 are fixed and cannot be customized.

A4.1 Communications Mode Areas

Data Position No.

| | | |
|------|-------------|---------------------------------------|
| 1857 | Setup area | Communications mode area (port 1) |
| 1888 | | |
| 1889 | | |
| 1920 | Status area | Communications mode area (port 2)* |
| 1921 | Setup area | |
| 1952 | Status area | |
| 1953 | | |
| 1984 | | |

* Reserved area for F3RZ81-0F.

Each communications mode area is divided into two sub-areas: setup area and status area. A user program writes communications mode settings to the setup area before issuing a request to set communications mode. It reads the status area to check the internal communications mode parameters of the module.

■ Communications Mode Setup Area

| Data Position No | | Description ² | Default |
|------------------|---------------------|--|--|
| Port 1 | Port 2 ⁴ | | |
| 1857 | 1921 | Character-to-character timeout processing | 0: receive successful; 1: receive error |
| 1858 | 1922 | Character length | 0: 7 bits; 1: 8 bits |
| 1859 | 1923 | Stop bits | 0: 1 bit; 1: 2 bits |
| 1860 | 1924 | Parity | 0: none; 1: odd; 2: even |
| 1861 | 1925 | Transmission speed (in bps) | 0: 300 4: 4800 8: 28800 12: 115200 1: 600 5: 9600 9: 38400 2: 1200 6: 14400 10: 57600 3: 2400 7: 19200 11: 76800 |
| 1862 | 1926 | Clear-to-send timeout interval | 0 to 32760 (ms); 0 means not monitored |
| 1863 | 1927 | Break transmission interval | 1 to 32760 (ms) |
| 1864 | 1928 | Start character of receive text | <div style="text-align: center;"> <div style="display: flex; justify-content: space-around; font-size: small;"> 15870 </div> <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-around;"> 0Start character </div> </div> - All 0's if no start character is used |
| 1865 | 1929 | End character (terminator) of receive text | <div style="text-align: center;"> <div style="display: flex; justify-content: space-around; font-size: small;"> 15870 </div> <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-around;"> First terminatorSecond terminator </div> </div> - All 0's for the first terminator if only one end character is used. - All 0's for the first and second terminators if no end character is used. |
| 1866 | 1930 | Receive text length | 0 to 1024 (number of characters on the line) ³ 0 means no receiving. |
| 1867 | 1931 | Character-to-character timeout interval | 0 to 32760 (ms) 0 means not monitored |
| 1868 | 1932 | Reserved | |
| 1869 | 1933 | | |
| 1870 | 1934 | RS control | 0: Always On 1: Turn on before sending |
| 1871 | 1935 | ER control | 0: Off 1: On |
| 1872 | 1936 | DR check | 0: Ignore DR when sending 1: Send only when DR is on |
| 1873 | 1937 | CD check | 0: Ignore CD when sending 1: Send only when CD is off |
| 1874 to 1886 | 1938 to 1950 | Reserved | |
| 1887 | 1951 | Send data area size | - In units of words 384 |
| 1888 | 1952 | Receive data area size | - Total size for send and receive data areas must not exceed 1792 words (3584 bytes) 512 |

*1: The default value is set with the SW2 switch.

*2: The default value is set with the SW1 switch.

*3: Depends on receive data area size.

*4: Reserved area for F3RZ81-0F.

**CAUTION**

The clear-to-send timeout interval, break transmission interval and receive character-to-character timeout interval have an error of 1 ms so the actual duration may be up to 1 ms shorter than the specified value.

■ Communications Mode Status Area

| Data Position No | | Description | |
|------------------|-----------|--|---|
| Port 1 | Port 2* | | |
| 1889 | 1953 | Character-to-character timeout processing | 0: receive successful 1: receive error |
| 1890 | 1954 | Character length | 0: 7 bits; 1: 8 bits |
| 1891 | 1955 | Stop bits | 0: 1 bit; 1: 2 bits |
| 1892 | 1956 | Parity | 0: none; 1: odd; 2: even |
| 1893 | 1957 | Transmission speed (in bps) | 0: 300 4: 4800 8: 28800 12: 115200 1: 600 5: 9600 9: 38400 2: 1200 6: 14400 10: 57600 3: 2400 7: 19200 11: 76800 |
| 1894 | 1958 | Clear-to-send timeout interval | 0 to 32760 (ms); 0 means not monitored |
| 1895 | 1959 | Break transmission interval | 1 to 32760 (ms) |
| 1896 | 1960 | Start character of receive text | <div style="text-align: center;"> 1 5 8 7 0 <div style="border: 1px solid black; display: inline-block; padding: 2px;">0</div> Start character </div> • All 0's if no start character is used |
| 1897 | 1961 | End character (terminator) of receive text | <div style="text-align: center;"> 1 5 8 7 0 <div style="border: 1px solid black; display: inline-block; padding: 2px;">First terminator</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">Second terminator</div> </div> All 0's for the first terminator if only one end character is used All 0's for the first and second terminators if no end character is used |
| 1898 | 1962 | Receive text length | 0 to 1024 (number of characters on the line) ³ 0 means no receiving |
| 1899 | 1963 | Character-to-character timeout interval | 0 to 32760 (ms); 0 means not monitored |
| 1900 | 1964 | Reserved | |
| 1901 | 1965 | | |
| 1902 | 1966 | RS control | 0: Always On 1: Turn on before sending |
| 1903 | 1967 | ER control | 0: Off 1: On |
| 1904 | 1968 | DR check | 0: Ignore DR when sending 1: Send only when DR is on |
| 1905 | 1969 | CD check | 0: Ignore CD when sending 1: Send only when CD is off |
| 1906-1916 | 1970-1980 | Reserved | |
| 1917 | 1981 | Send data area size | |
| 1918 | 1982 | Receive data area size | |
| 1919 | 1983 | Control line status | <div style="text-align: center;"> 15 5 4 3 2 1 0 <div style="border: 1px solid black; display: inline-block; padding: 2px;">0</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">R</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">E</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">C</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">D</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">C</div> <div style="border: 1px solid black; display: inline-block; padding: 2px;">D</div> </div> |
| 1920 | 1984 | Setup error information | <div style="text-align: center;"> 15 8 7 0 <div style="border: 1px solid black; display: inline-block; padding: 2px;">Data position no.</div> </div> |

* Reserved area for F3RZ81-0F.

● Character-to-character timeout processing

Character-to-character receive timeout is always monitored. When timeout occurs, it is considered either a receive error (the Receive Error input relay turns on) or the normal completion of receive data (the Receive Completed input relay turns on) according to this setting.

If this setting is 0, a character-to-character receive timeout is always considered the normal completion of receive data and the Receive Completed input relay turns on. This

setting is useful when the receive text length or the end character cannot be specified. When a character-to-character receive timeout occurs, the character-to-character receive timeout bit of the Receive data Status register turns on irrespective of this setting.

- **Character length**

This setting is used to specify how many bits make up one character.

- **Stop bits**

This setting is used to specify how many bits are used to signify the end of a character.

- **Parity**

This setting is used to define the parity bit, which is used for error detection.

- **Transmission speed**

This setting is used to specify the transmission speed.

- **Clear-to-send timeout interval**

This setting is used to specify the maximum time allowed for starting and completing a transmission before timeout occurs. Sending cannot start if the send condition specified by the DR Check or CD Check setting is not satisfied, or if the communications cable is loose or not connected. If a timeout occurs, a send error is generated. If this setting is 0, timeout will never occur.

- **Break transmission interval**

This setting is used to specify the duration of a break signal. It cannot be set to 0 ms.

- **Start character of receive text**

This setting is used to define the start character that signifies the beginning of receive text. No start character is attached to send text.

- **End character of receive text**

This setting is used to define the end character that signifies the end of receive text. No end character is attached to send text.

- **Receive text length**

This setting is used to specify the number of characters for delimiting receive text. This setting may not exceed a user-defined receive data area size.



CAUTION

- If the receive text length is set to a value larger than the receive data area size, the receive data area size is used. If the receive text length is set to a value larger than 3584, however, a Set Communications Mode Error is generated.
- The receive text length is ignored if the receive data area size is set to 0.
- If the receive text length is set to 0, the module can receive no data.

● Character-to-character timeout interval

This setting is used to define the character-to-character receive timeout interval, which is the maximum allowable lapse between two successive characters in the same text. When a timeout occurs, whether it is considered a receive error or the normal completion of receive text depends on the character-to-character timeout processing setting.

● RS (Request to Send) control

The RS control signal is used to notify remote data equipment that the module has data to send.

This setting is used to specify whether the module should always turn on the RS signal or should turn on the RS signal only when it has data to send.

● ER (Data Terminal Ready) control

The ER control signal is used to notify remote data equipment that the module is ready to receive data. This control signal can be turned on or turned off by a user program.

● DR (Data Set Ready) check

When connecting the module to remote DTE (data terminal equipment), the DR terminal of the module is normally connected to the ER terminal of the remote DTE to monitor whether the remote DTE is ready to receive data from the module.

This setting is used to specify whether the module should check that the DR signal is on before sending data.

● CD (Data Carrier Detect) check

When connecting the module to remote DTE (data terminal equipment), the CD terminal of the module is normally connected to the RS terminal of the remote DTE to monitor whether the remote DTE has data to send.

This setting is used to specify whether the module should check that the CD signal is off before sending data.

● Control line status

A user program may read the control line status to monitor the status of each control signal.

● Send data area size, receive data area size

Use these settings to specify the size of the send and receive data areas respectively.

A total space of 1792 words (3584 bytes) may be freely shared among the send and receive data areas. If a send or receive data area size is set to 0, however, that area is disabled and the related function is no longer available.



CAUTION

-
- If the send data area size of a port is set to 0, the send error is generated when the request to send is issued for that port.
 - If the receive data area size of a port is set to 0, it will not be available for receiving.
 - Do not change the setting of the send data area size or the receive data area size during communication.
 - If the setting of the send or receive data area size is changed during communication, beware that there may be old data remaining in the data areas.
-

A4.2 Send and Receive Data Areas

● Allocation of send and receive data areas

| Data Position No. | F3RZ81-0F | Data Position No. | F3RZ82-0F |
|----------------------|--|----------------------|--|
| 1 | Send data area (port 1) (768 bytes) | 1 | Send data area (port 1) (768 bytes) |
| 384 | | 384 | |
| 385 | Receive data area (port 1) (1024 bytes) | 385 | Receive data area (port 1) (1024 bytes) |
| 896 | | 896 | |
| 897 | Extended send/receive data area | 897 | Send data area (port 2) (768 bytes) |
| 1792 | | 1280 | |
| 1793 | | 1281 | Receive data area (port 2) (1024 bytes) |
| 1794 | | 1792 | |
| 1795 | | 1793 | Send data byte count (port 1) |
| 1796 | Send data byte count (port 1) | 1794 | Send status (port 1) |
| 1797 | Send status (port 1) | 1795 | Receive data status (port 1) |
| 1798 | Receive data status (port 1) | 1796 | Receive data byte count (port 1) |
| 1799 | Receive data byte count (port 1) | 1797 | Send data byte count (port 2) |
| 1800 | Reserved | 1798 | Send status (port 2) |
| | Reserved | 1799 | Receive data status (port 2) |
| | Reserved | 1800 | Receive data byte count (port 2) |
| | Reserved | | |



CAUTION

- You may customize the send data area size and receive data area size for using data positions between 1 and 1792.
- Data positions above 1792 are fixed and cannot be customized.

● Send data area

This area is used to store data to be sent.

● Receive data area

This area is used to store data received.

● Extended send/receive data area

For F3RZ81-0F, this is extra data space, which can be used by modifying the send data area size and/or the receive data area size from their respective default setting values of 384 and 512 words.

● Send data byte count

This area is used to store the number of bytes to be sent. Following a request to send, data is sent until the specified number of bytes is reached.

● Send status

This area is used to store the completion status after transmission.

| Status | Error Code (Decimal) | Description |
|----------------------|-------------------------|--------------------------|
| Send successful | 0000 | |
| Send data size error | 0100 | |
| Send timeout | 0201 | Cable connection failure |
| | 0202 | DR check error |
| | 0203 | CD check error |

● Receive data status

This area stores the status of the received text stored in the receive data area. The status is a combination of error bits (see the table below). An error bit is turned on if the corresponding error is detected for any byte of the received text. If an error bit is turned on, there is no way to tell which byte is the cause.

| 15 to 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|----------|------|-----|-----|------|------|-------|
| Reserved | ORER | FER | PER | IBOF | RCTO | BREAK |

ORER : Overrun error

FER : Framing error

PER : Parity error

IBOF : Receive buffer overflow

RCTO : Character-to-character receive timeout

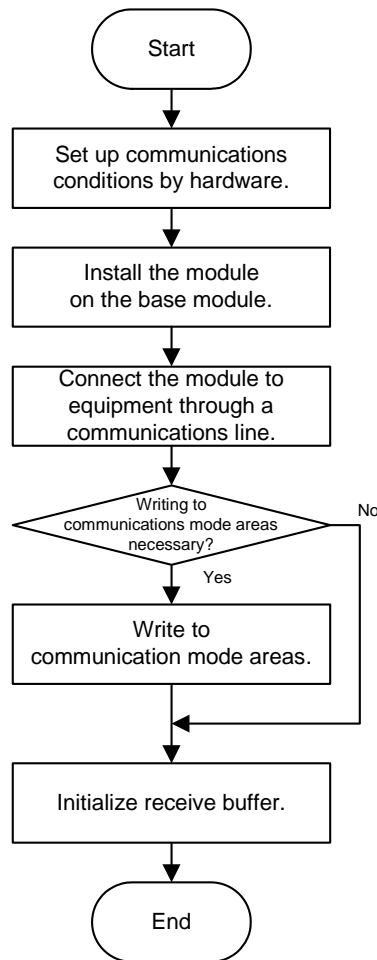
BREAK : Break signal received

● Receive data byte count

This area stores the number of bytes of data received. By reading the value stored in this area, a program can determine the size of received data. The end character in received data is automatically deleted when the received data is stored in the receive data area.

A5. Startup Preparation

The flowchart below shows the things to be done to prepare for communications.



See Also:

Set the module and the remote equipment with the same communications conditions.

A2.2, "Switch Setup"

A2.4, "Attaching/detaching the Module"

A2.3, "External Wiring"

Not necessary if the settings with the switches on the side of the module are used as they are.

A3, "List of I/O Relays"

A4.1, "Communications Mode Areas"

A7.1, "Communications Mode Areas"

The receive buffer should be initialized to discard any unwanted data due to electric noise that may be present on the communications line.

A7.2, "Initializing Receive Buffer"

A6. Data Communications

A6.1 Format of Received Text

The F3RZ81-0F/F3RZ82-0F ladder communication module may recognize a block of received text by any of the following three means:

- By receiving a terminator
- By receiving the number of characters designated by the Receive Text Length setting in the communications mode area
- By detecting a character-to-character receive timeout



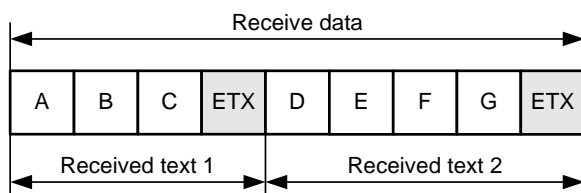
CAUTION

-
- A block of received text is recognized when any of the above three conditions is met.
 - You may explicitly disable individual conditions if so desired.
 - However, you may not disable the condition defined by the Receive Text Length setting.
-

● Receiving a terminator

A block of text is recognized when a terminator (end characters) is received. The default terminator is the CR-LF character pair.

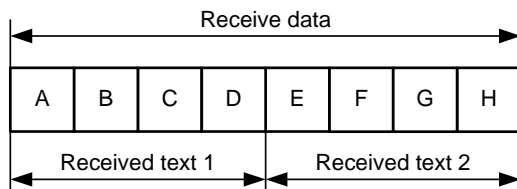
Example: If ETX (\$03) is used as a terminator



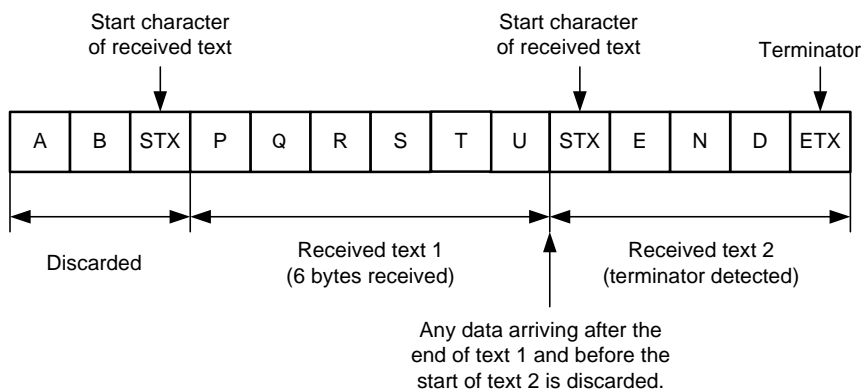
● Receive Text Length setting

A block of text is recognized when the number of bytes designated by the Receive Text Length setting (between 1 and 1024) is received. If a start character of receive text is specified, bytes for received text are counted starting from the character following the start character. The default value for the Receive Text Length setting is 1024 (bytes).

Example 1: Receive Text Length is set to 4 (bytes)



Example 2: Receive Text Length is set to 6 (bytes) with the use of start character STX (\$02) and terminator ETX (\$03)

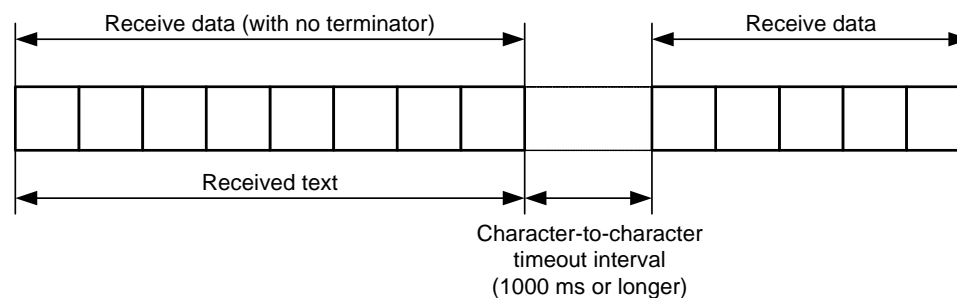


● Detecting a character-to-character receive timeout

A block of text is recognized when the next character is not received after a specified timeout interval. This is especially useful for receiving binary data or text with no terminator.

The default character-to-character timeout interval is 1500 ms

Example: Character-to-character timeout interval is set to 1000 ms and no terminator is used in receive data



When a character-to-character receive timeout occurs, it is either considered the normal end of received text as discussed above or a receive error depending on the Character-to-Character Timeout Processing setting.

A6.2 Break Signal

The break signal is a special signal consisting of all '1' bits, which is sent to generate a framing error. The ladder communication module is capable of sending a break signal, as well as recognizing a break signal.

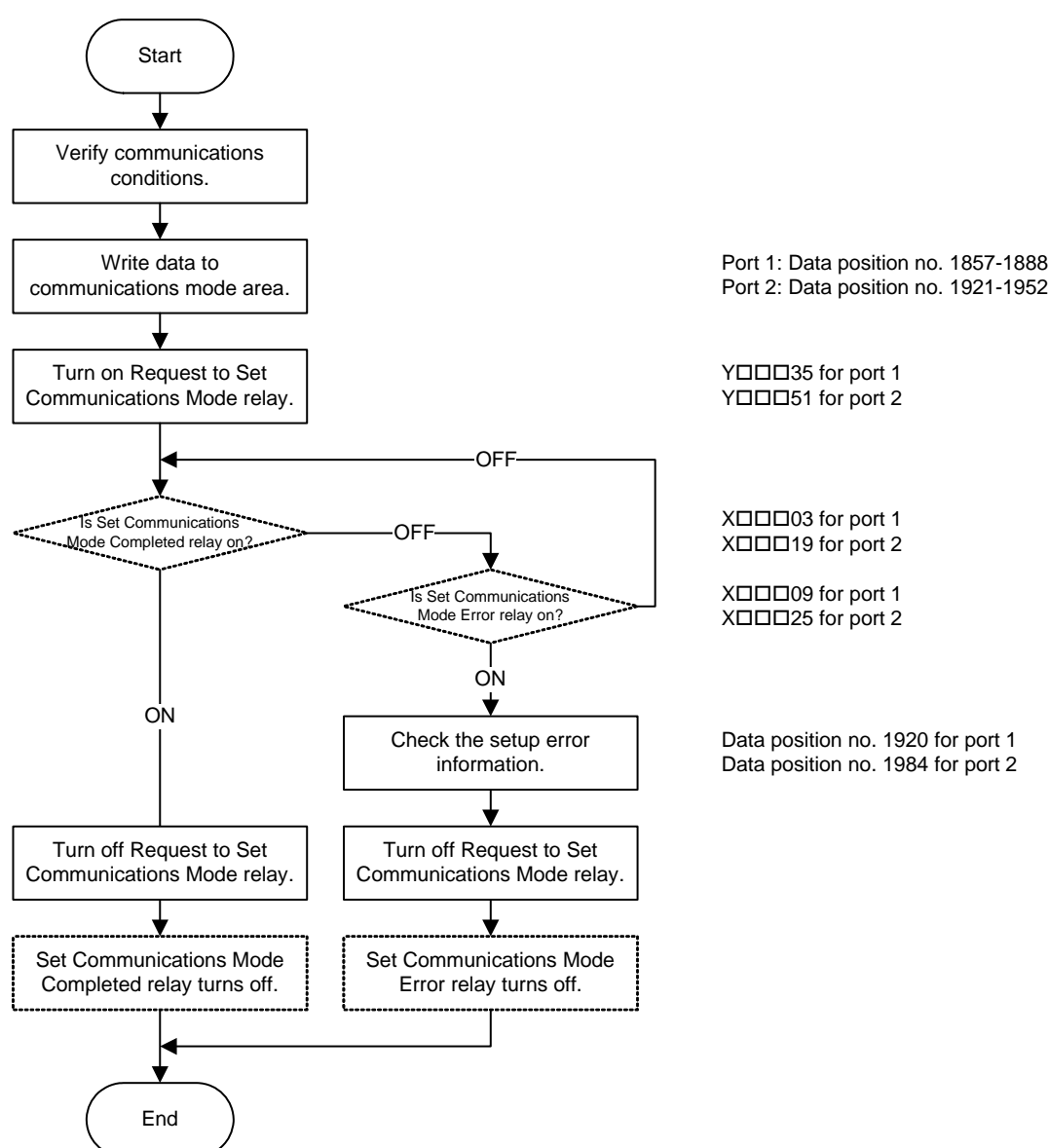
A7. Programming

A7.1 Communications Mode Areas

Before data can be sent to remote equipment, communications conditions must be set up. To support a variety of communications protocols, the F3RZ81-0F/F3RZ82-0F ladder communication module allows many functions to be configured using the communications mode areas.

For instance, while the transmission speed and the data format definition can be specified using the SW1 rotary switch and the SW2 DIP switch on the right side of the module respectively, they can also be set by software, by writing to the communications mode areas from the FA-M3 CPU module using a program. This means that the settings can be changed even after the ladder communication module is installed on the base unit. For F3RZ82-0F, the SW1 and SW2 settings apply to both ports 1 and 2, but the settings can be changed by software for individual ports.

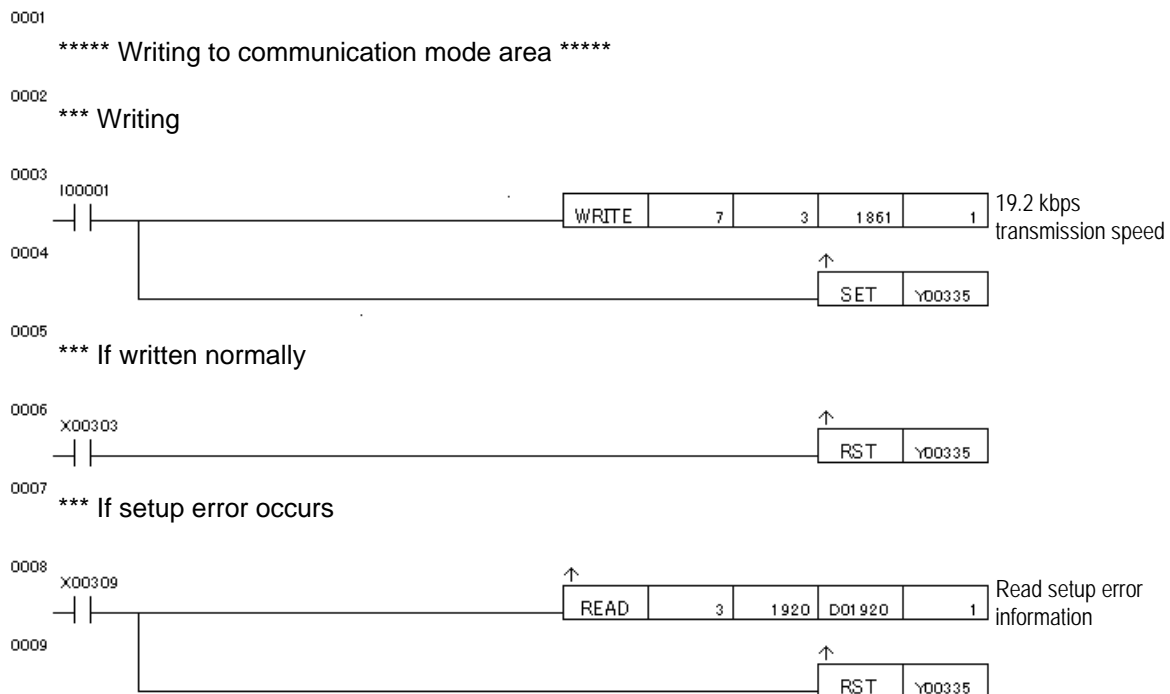
● Writing to communications mode area



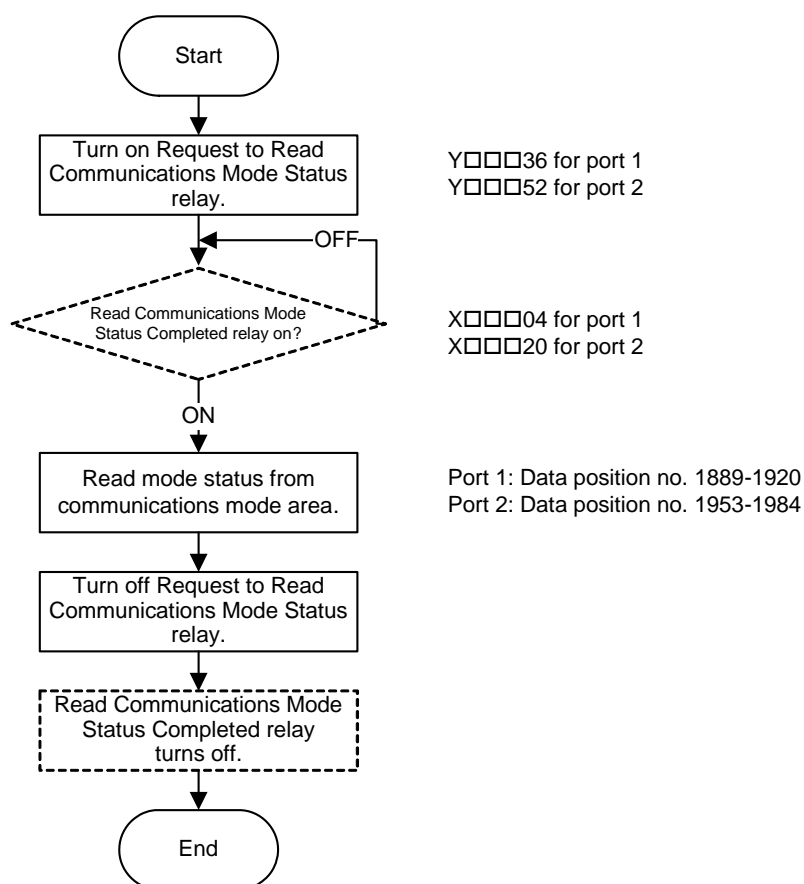
● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.
- Port 1 is used for communications.
- Transmission speed is 19200 bps.



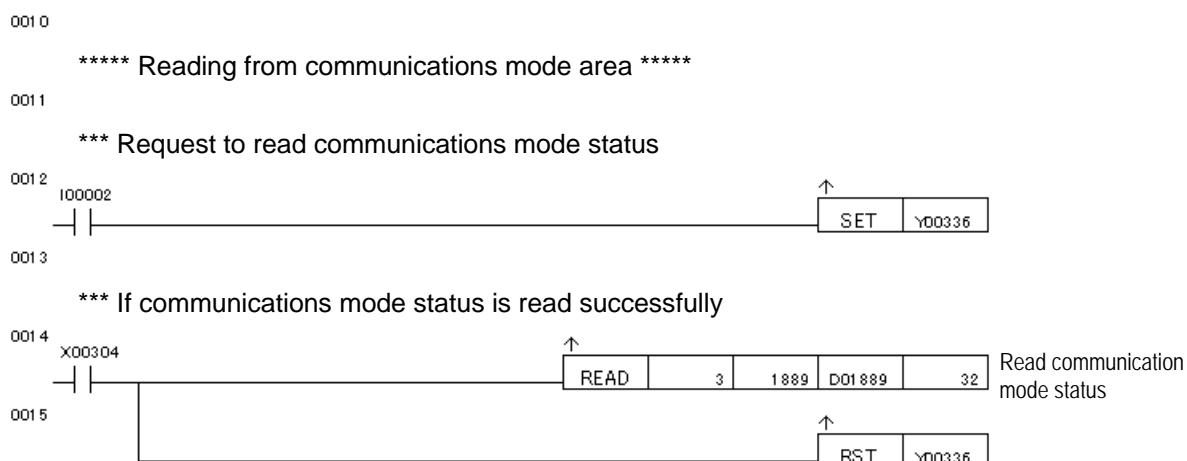
● Reading from communications mode area



● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.
- All the contents of the communications mode area for port 1 are to be read.



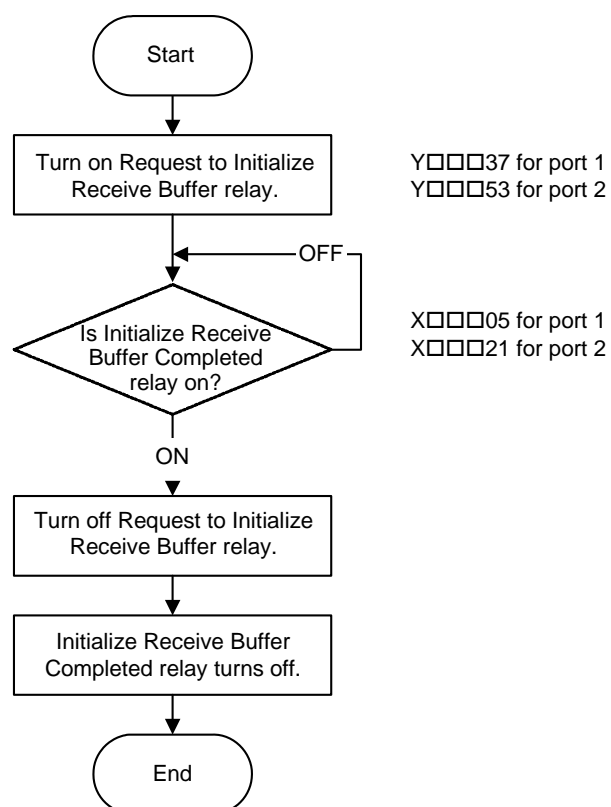
A7.2 Initializing Receive Buffer

When the module establishes connection with a remote device or when a remote device is switched on, noise (or unwanted data) may arise and propagate through the communications line. To avoid receiving unwanted data inadvertently, it is advisable to initialize the receive buffer before starting communications, in addition to setting up the communications conditions.

The receive buffer initialization function performs the following actions:

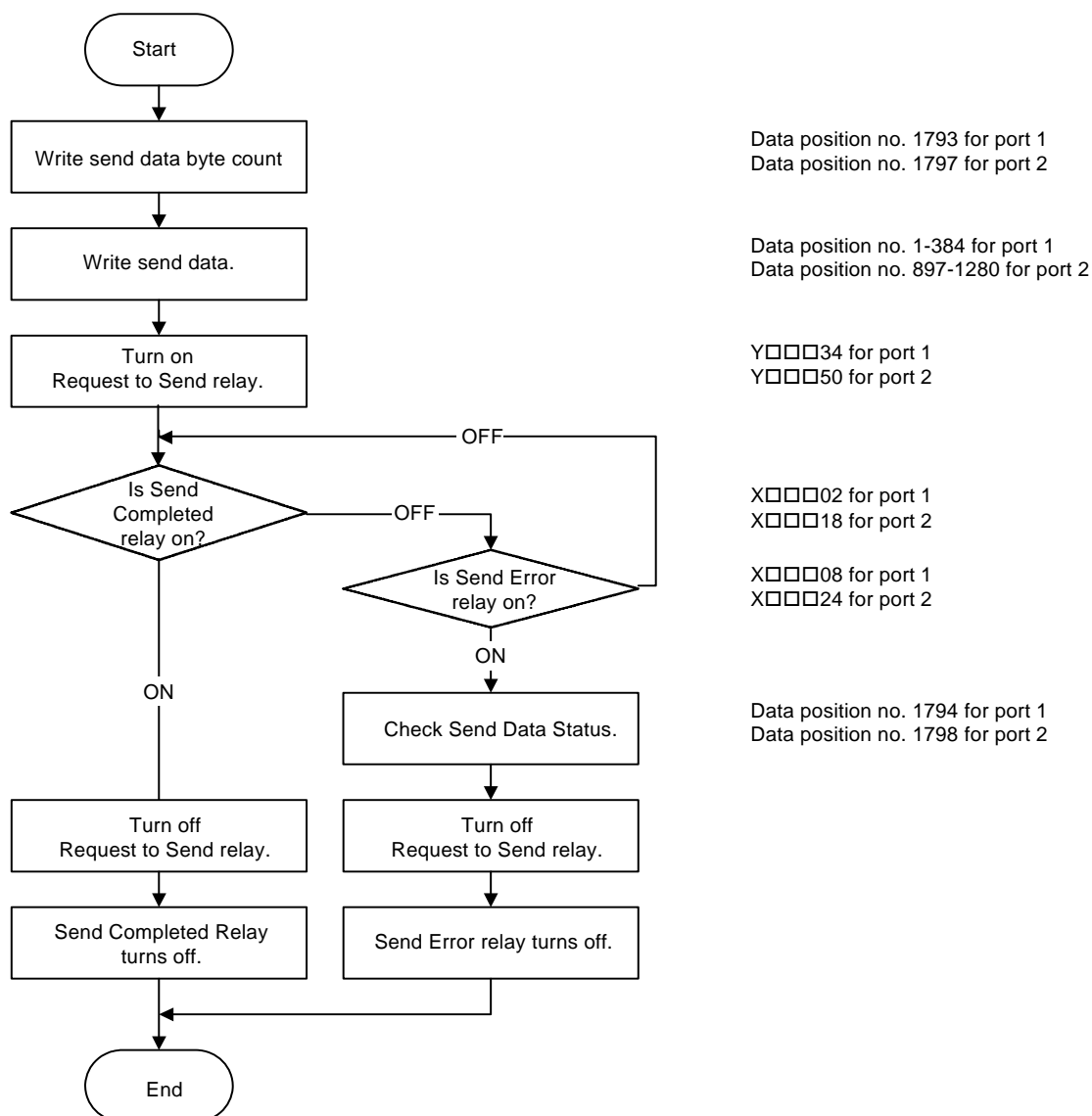
- Clears the receive buffer (rotary buffer). Beware that the receive data area is different from the receive buffer and is not initialized by this function.
- Resets the communications controller.

● Initializing receive buffer



A7.3 Sending Data

● Send procedure



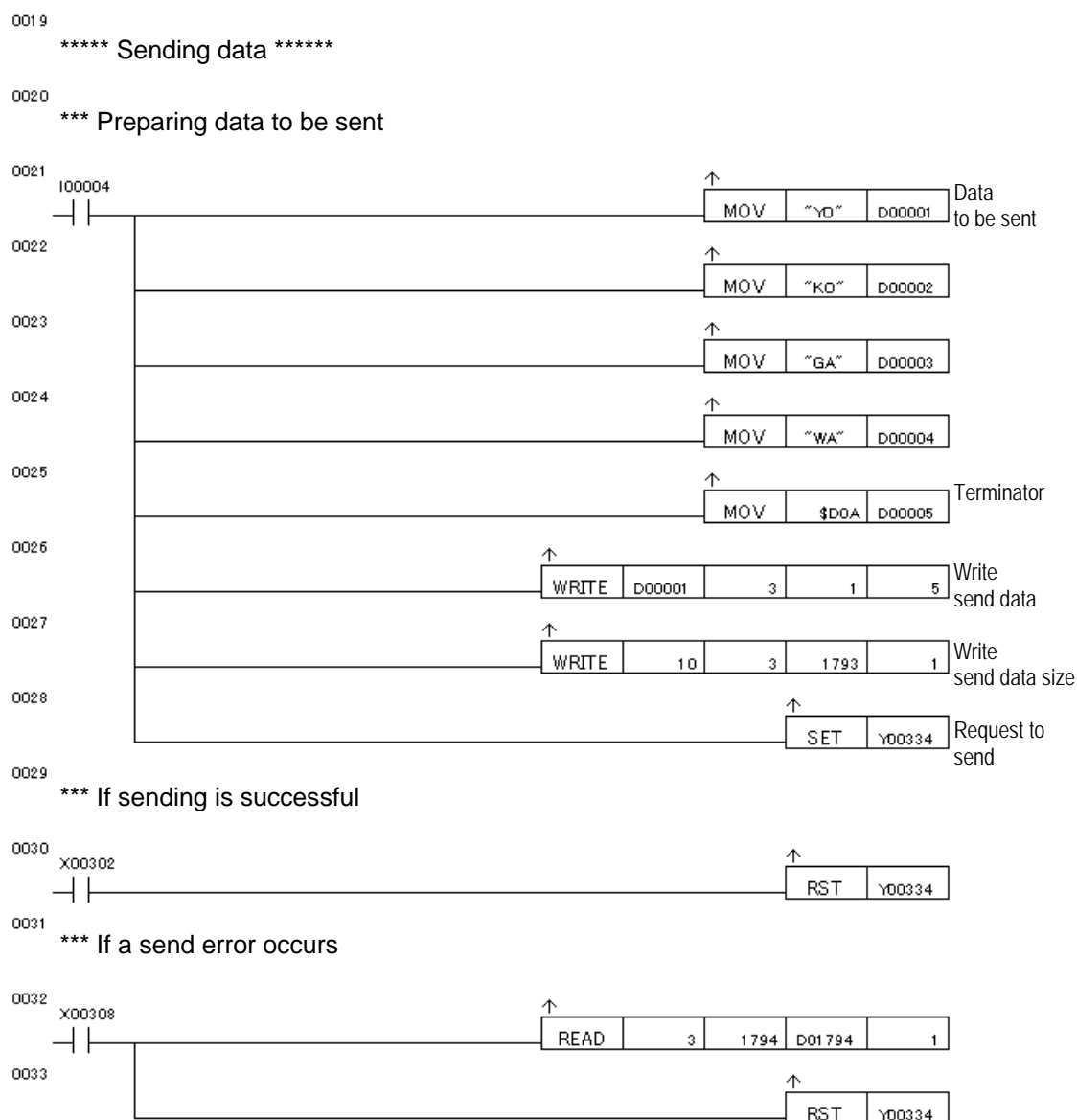
CAUTION

- This procedure assumes that default data position numbers are used for the send data area.
- The data position numbers will be different if the size of the send or receive data area is redefined by a user.

● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.
- Port 1 is used for communications.
- Text to be sent is "YOKOGAWA".
- End characters are a pair of CR and LF (\$0D and \$0A) characters.

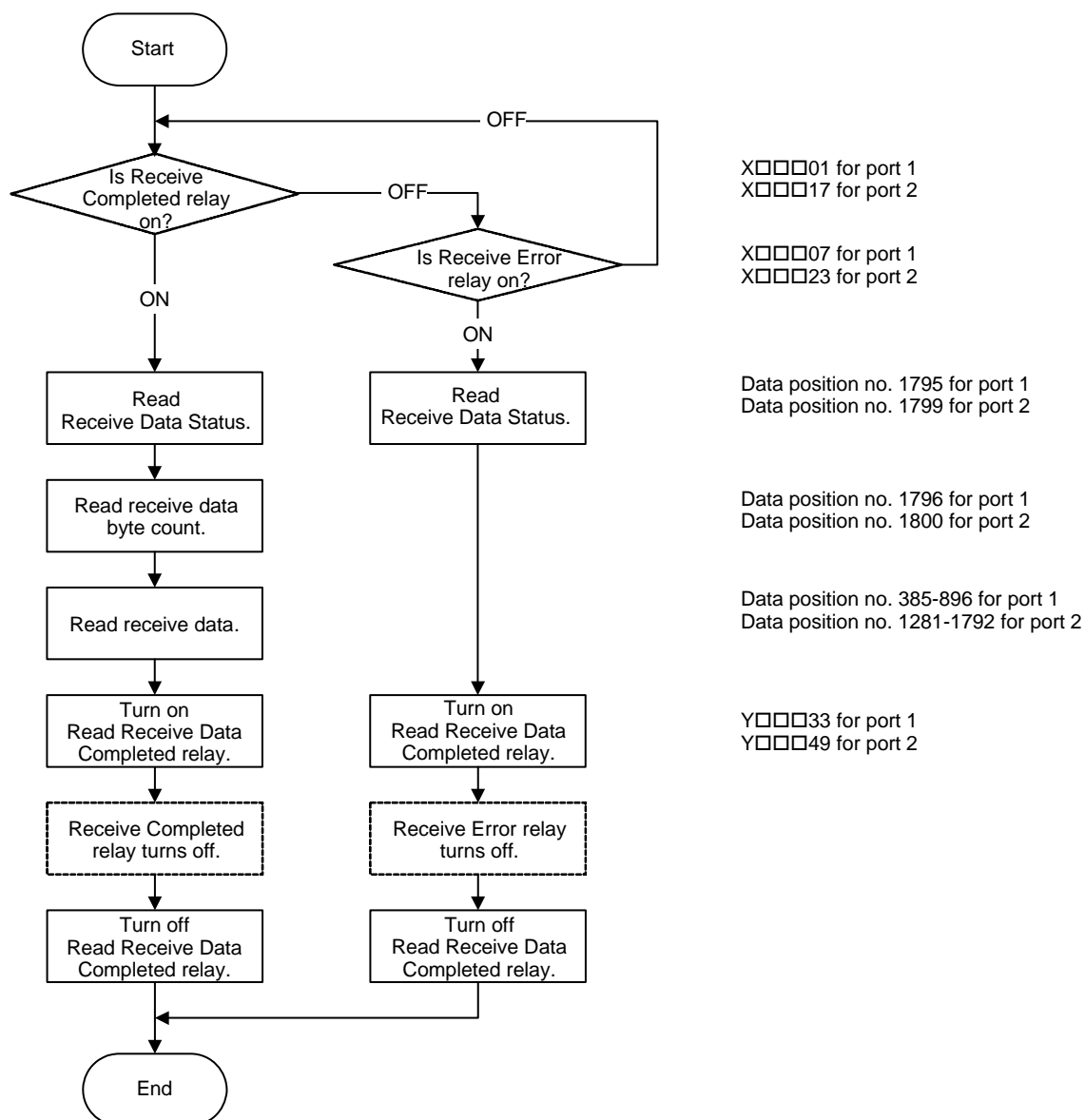


CAUTION

The character string input function used to store send data is only supported for F3SP28, 38, 53, 58, and 59-□N/□H/□F CPU modules.

A7.4 Receiving Data

● Receive procedure



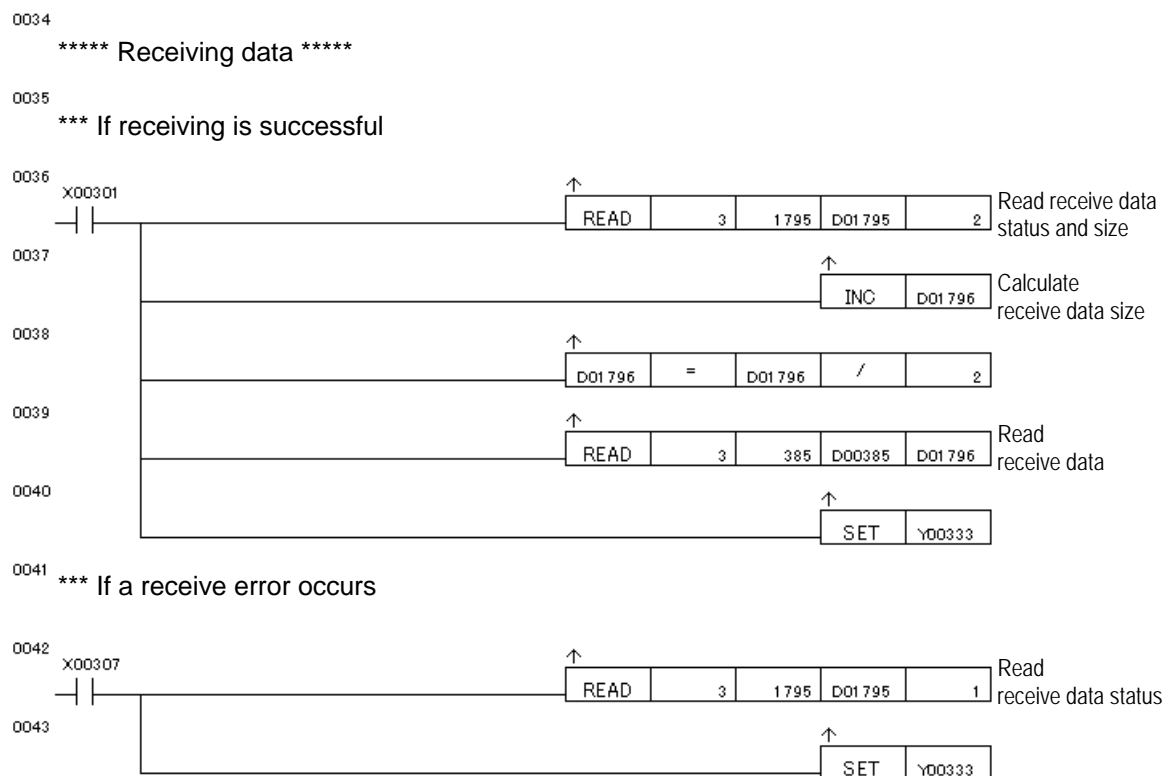
CAUTION

- This procedure assumes that default data position numbers are used for the receive data area.
- The data position numbers will be different if the size of the send or receive data area is re-defined by a user.

● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.
- Port 1 is used for communications.

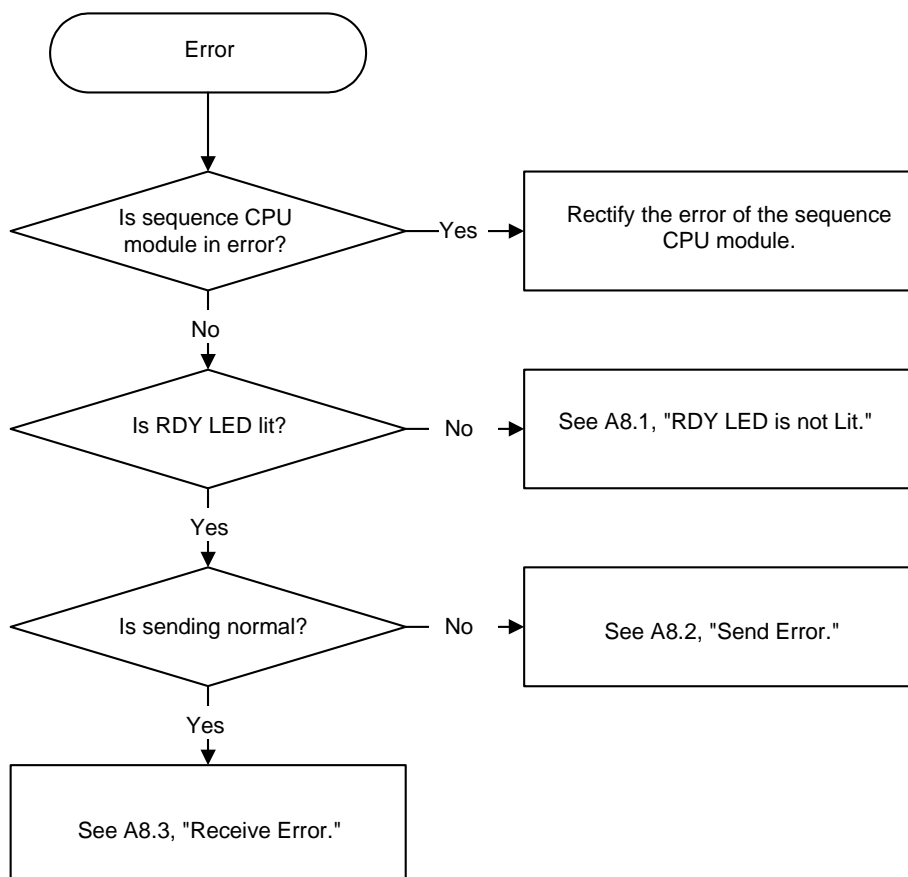


CAUTION

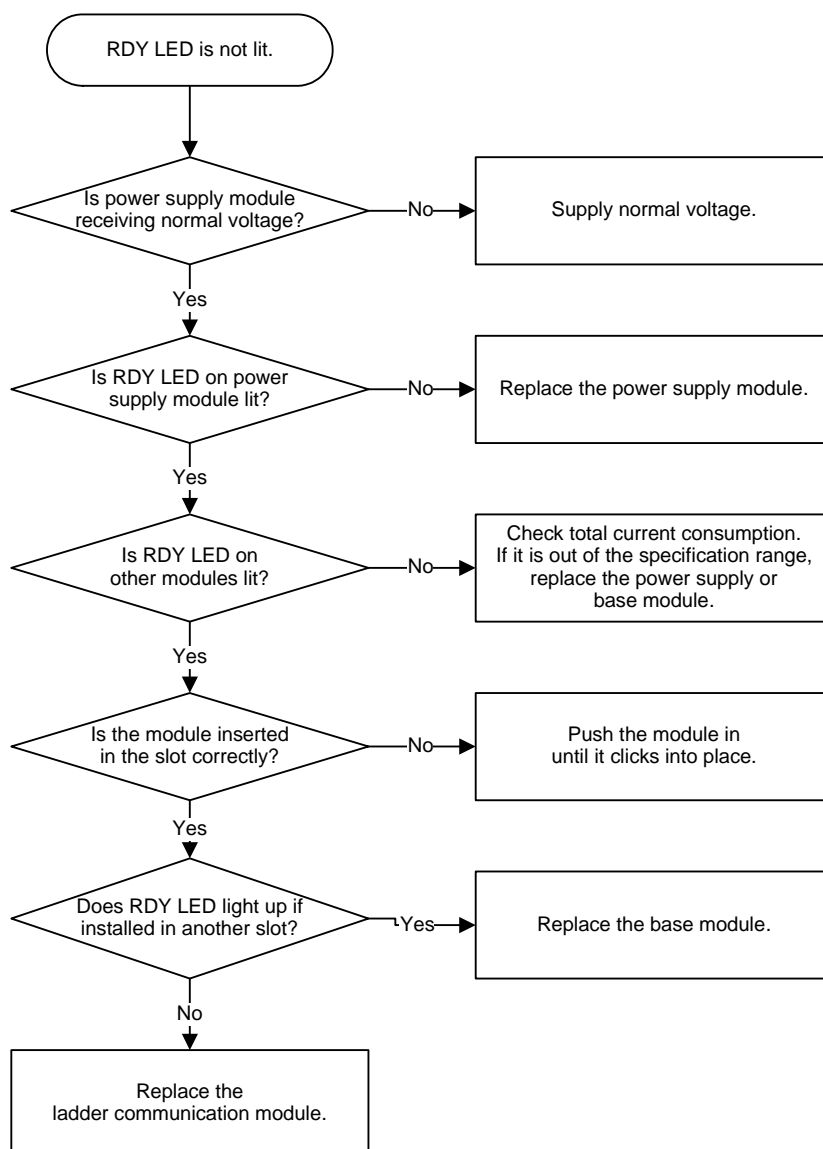
The receive data size is stored in units of bytes in the module. You must convert the size in bytes into size in words when reading the received data into the CPU module using the READ instruction.

A8. Troubleshooting

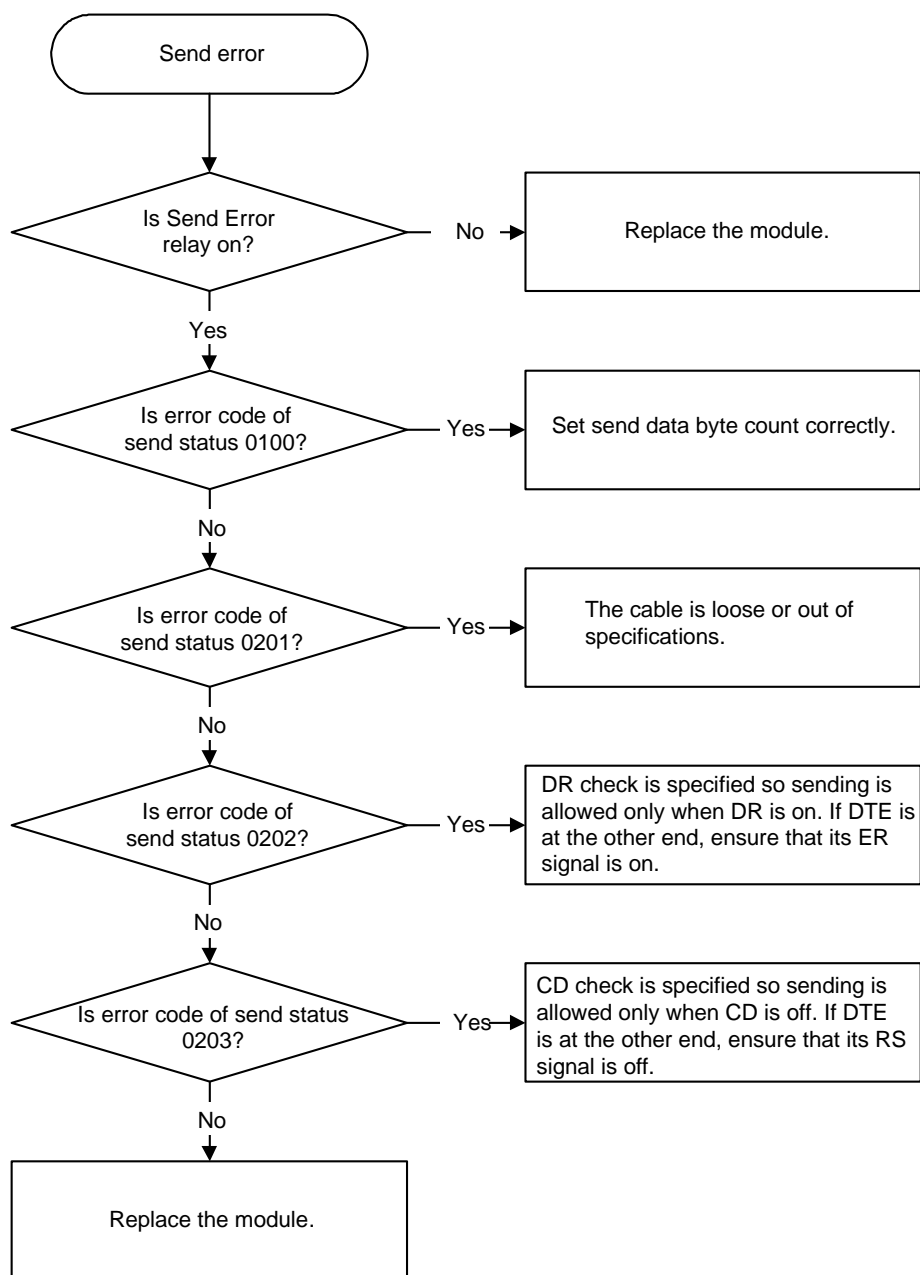
These are troubleshooting flowcharts for common errors involving the module.



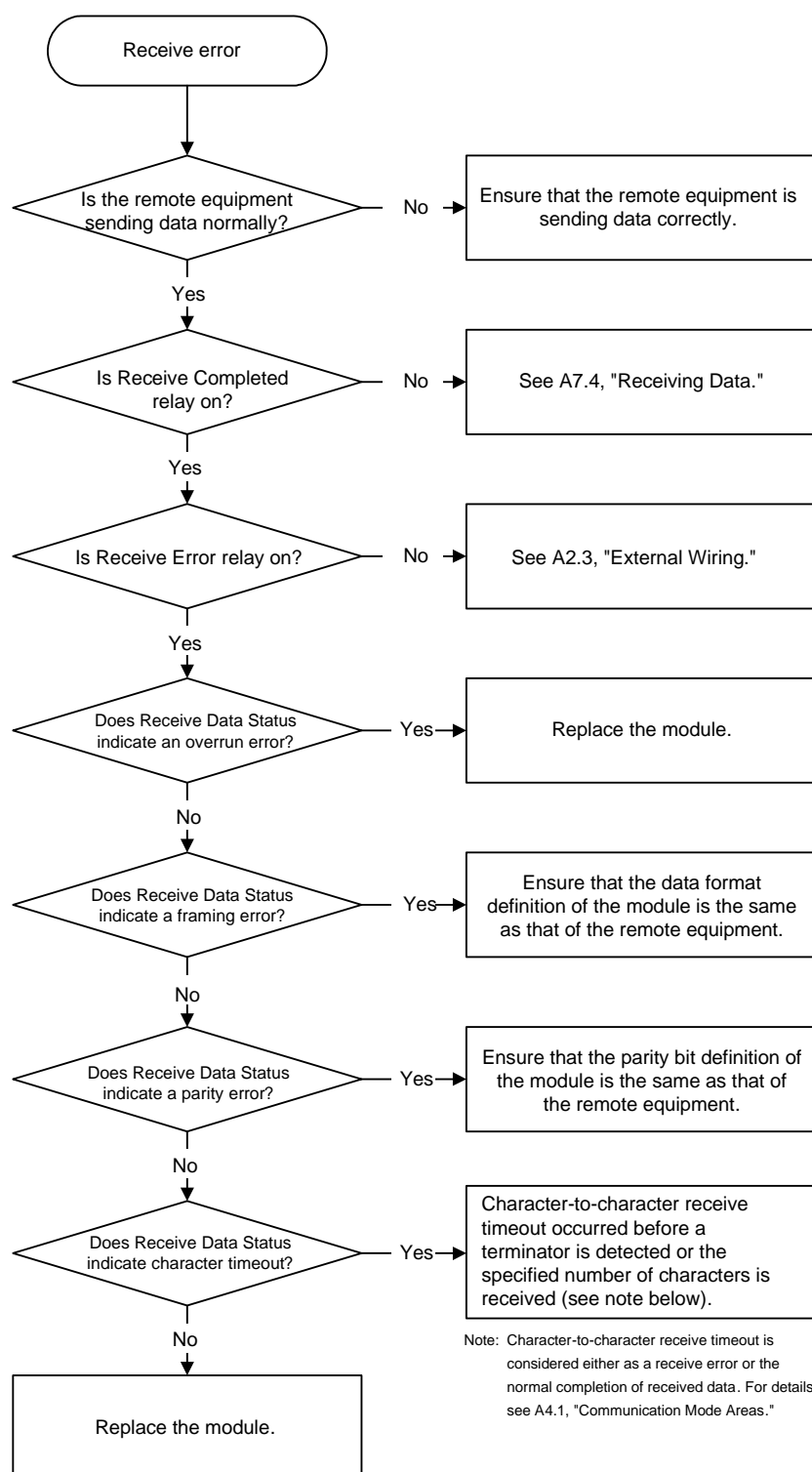
A8.1 RDY LED is not Lit



A8.2 Send Failure



A8.3 Receive Failure



Appendix A1. ASCII Code Table

| High Low | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------------|-----|-----|----|---|---|---|---|-----|
| 0 | NUL | DLE | SP | 0 | @ | P | ` | p |
| 1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 2 | STX | DC2 | " | 2 | B | R | b | r |
| 3 | ETX | DC3 | # | 3 | C | S | c | s |
| 4 | EOT | DC4 | \$ | 4 | D | T | d | t |
| 5 | ENQ | NAK | % | 5 | E | U | e | u |
| 6 | ACK | SYN | & | 6 | F | V | f | v |
| 7 | BEL | ETB | ' | 7 | G | W | g | w |
| 8 | BS | CAN | (| 8 | H | X | h | x |
| 9 | HT | EM |) | 9 | I | Y | i | y |
| A | LF | SUB | * | : | J | Z | j | z |
| B | VT | ESC | + | ; | K | [| k | { |
| C | FF | FS | , | < | L | ¥ | l | |
| D | CR | GS | - | = | M |] | m | } |
| E | SO | RS | . | > | N | ^ | n | ~ |
| F | SI | US | / | ? | O | _ | o | DEL |

FA-M3**Ladder Communication Module****Part A: F3RZ81-0F/F3RZ82-0F**

IM 34M6H22-02E 2nd Edition

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FA-M3**Ladder Communication Module****Part B: F3RZ91-0F**

IM 34M6H22-02E 2nd Edition

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B1. Overview

The F3RZ91-0F Ladder Communication Module can be used with an FA-M3 CPU module for RS-422/485 communications. It has one terminal block, or port, which supports a maximum transmission distance of 1200 m.

Any input relay of the F3RZ91-0F may be used to raise an interrupt.

Table B1.1 Models of Ladder Communication Module

| Model | Description |
|-----------|--|
| F3RZ91-0F | RS-422/485 ladder communication module |

B2. Specifications

B2.1 Standard Specifications

■ Model and Suffix Codes

| Model | Suffix Code | Style Code | Option Code | Description |
|--------|-------------|------------|-------------|-------------------------------------|
| F3RZ91 | -0F | | | Max 115.2 kbps, one RS-422/485 port |

■ Operating Environment

The F3RZ91-0F may be used with all CPU modules.

■ General Specifications

| Item | Specifications | Item | Specifications |
|-----------------------|---|---------------------|-------------------------------|
| Operating temperature | 0 to 55°C | Storage temperature | -20 to 75°C |
| Operating humidity | 10 to 90% RH (non-condensing) | Storage humidity | 10 to 90% RH (non-condensing) |
| Operating environment | Must be free of corrosive gases, flammable gases and heavy dust | | |

■ Physical Specifications

| Item | Specifications | Item | Specifications |
|-----------------------|------------------------|---------------------|-----------------------------------|
| Interface | EIA RS-232-C compliant | Current consumption | 350 mA |
| Number of ports | 1 (isolated) | External dimensions | 28.9 (W) x 100 (H) x 83.2 (D) mm* |
| Transmission distance | 1200 m max. | Weight | 120 g |
| Connector | Terminal block | | |

*: Dimensions excluding protrusions. For details, see the External Dimensions drawing.

■ Function Specifications

| Item | | Specifications | Default |
|--------------------------------|---|---|-----------------------|
| Connection method | | Point to point | — |
| Transmission mode | | Full-duplex/half-duplex | — |
| Synchronization | | Start-stop synchronization | — |
| Communication protocol | | No protocol | — |
| Data format | Character length | 7 or 8 bits | *1 |
| | Stop bits | 1 or 2 bits | *1 |
| | Parity bit | None, even, or odd | *1 |
| Transmission speed | | 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, or 115200 bps | *2 |
| Communication buffer | Send buffer | Text buffer (1792 bytes max. ^{*3}) | — |
| | Receive buffer | 8192-byte rotary buffer (FIFO buffer) | — |
| Format of received text | Start character | - Yes or no - Any single character | No |
| | End character (terminator) | - Yes or no - Up to 2 characters long, any characters - Also used as send terminator. | \$0D and \$0A (CR-LF) |
| | Text length | Can be specified as any number between 1 and 1792 ^{*3} . | 1024 |
| | Character-to-character timeout interval | 0 to 32760 ms in 1 ms increments, accurate to 1 ms (0 means not monitored) | 1.5 s |
| Clear-to-send timeout interval | | 0 to 32760 ms in 1 ms increments, accurate to 1 ms (0 means not monitored) | Not monitored |
| Break transmission interval | | 1 to 32760 ms in 1 ms increments, accurate to 1 ms | 400 ms |

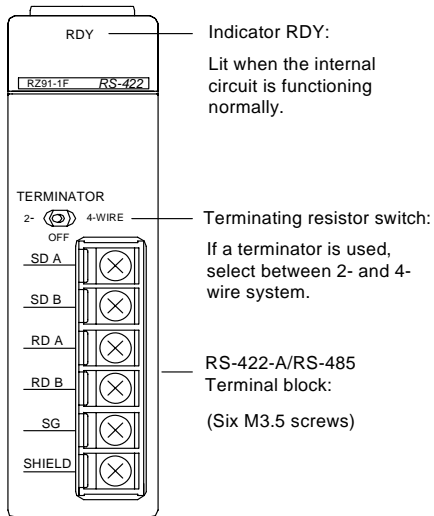
*1: Default values are set with the data format switch (SW2).

*2: Default values are set with the transmission speed switch (SW1).

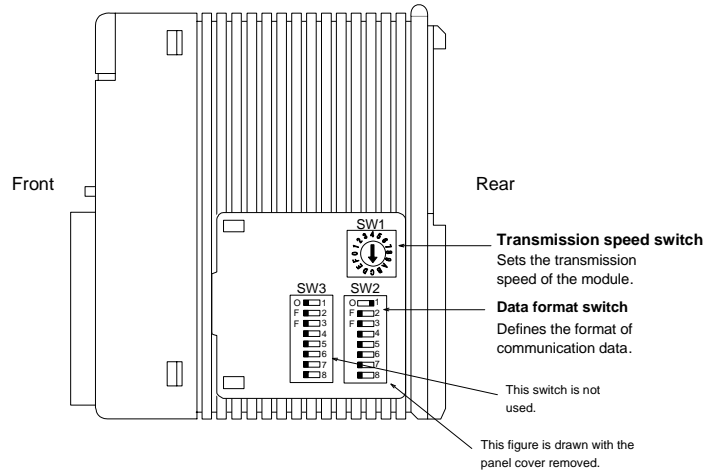
*3: May be increased up to 1792 bytes using the Send Data Area Size and Receive Data Area Size data registers.

■ Components and Functions

● Front view

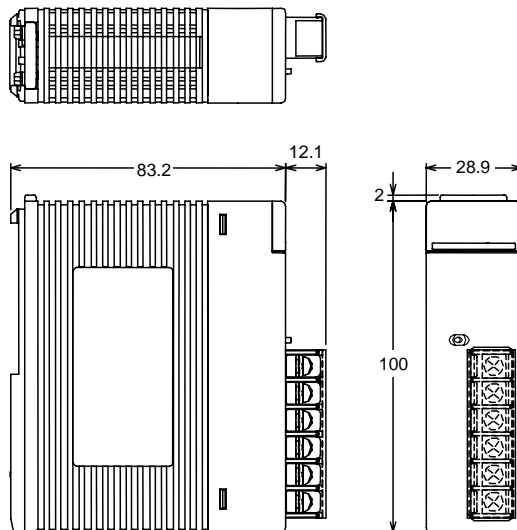


● Right side view



■ External Dimensions

(Unit: mm)



B2.2 Switch Setup

■ Switches on the Module

Always set the three switches on the side of the F3RZ91-0F module before installing it on the FA-M3 base module. See Figure B2.1 for the switch names and locations.

● Right side view

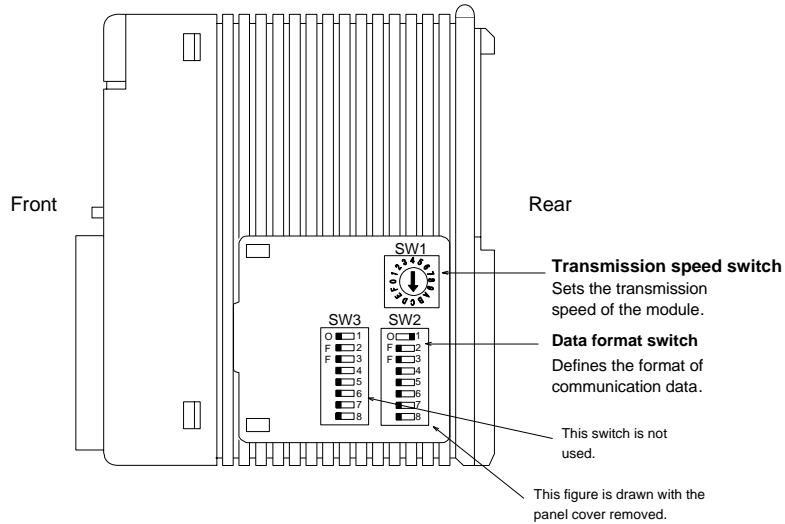
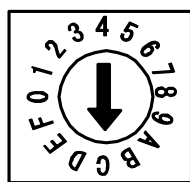


Figure B2.1 F3RZ91-0F Switches

● Transmission speed switch (SW1)

This is a hexadecimal rotary switch for setting up the transmission speed of the module. You can set the switch by inserting a small flat-blade screwdriver in its arrow-shaped slit and rotating it to a desired position between 1 and C (positions D to F are not available). The factory setting is 'C' (= 115.2 kbps).



| SW1 Position | Transmission Speed (bps) | Remarks |
|--------------|--------------------------|-----------------|
| 0 | 300 | |
| 1 | 600 | |
| 2 | 1200 | |
| 3 | 2400 | |
| 4 | 4800 | |
| 5 | 9600 | |
| 6 | 14400 | |
| 7 | 19200 | |
| 8 | 22800 | |
| 9 | 38400 | |
| A | 57.6K | |
| B | 76.8K | |
| C | 115.2K | Factory setting |
| D-F | ----- | Not available |

Figure B2.2 F3RZ91-0F Transmission speed Switch

● Data format switch (SW2)

This is an 8-element DIP switch for defining a character frame. Elements 1-4 may be set to either the ON or OFF position to define character length, parity and stop bits. The factory setting has element 1 set to ON and elements 2-8 set to OFF.

| | | | | | | |
|--|--------------|------------------|--------|--------|-----------|-----|
| | SW2 Elements | Function | OFF | ON | Default | |
| | 1 | Character length | 7 bits | 8 bits | 8 bits | ON |
| | 2 | Parity | No | Yes | No parity | OFF |
| | 3 | | Odd | Even | ---- | OFF |
| | 4 | Stop bits | 1 bit | 2 bits | 1 bit | OFF |
| | 5 | Not used | ---- | ---- | ---- | OFF |
| | 6 | Not used | ---- | ---- | ---- | OFF |
| | 7 | Not used | ---- | ---- | ---- | OFF |
| | 8 | Not used | ---- | ---- | ---- | OFF |

- SW2-3 is available only when SW2-2 is set to ON (= using parity).
 - Always set SW2-5 to SW2-8 to OFF.

Figure B2.3 F3RZ91-0F Data format Switch

● Reserved switch (SW3)

The F3RZ91-0F does not use the SW3 switch. The module must be used with all elements of this switch set to OFF (factory setting).

| | | | | | | |
|--|--------------|----------|-----|----|---------|-----|
| | SW3 Elements | Function | OFF | ON | Default | |
| | 1 | Not used | | | | OFF |
| | 2 | Not used | | | | OFF |
| | 3 | Not used | | | | OFF |
| | 4 | Not used | | | | OFF |
| | 5 | Not used | | | | OFF |
| | 6 | Not used | | | | OFF |
| | 7 | Not used | | | | OFF |
| | 8 | Not used | | | | OFF |

Figure B2.4 F3RZ91-0F Reserved Switch



CAUTION

Ensure that all unused switch elements are set to OFF.

B2.3 External Wiring

■ RS-422-A/RS-485 Terminal Block

The terminal block of the F3RZ91-0F has six terminals (with M3.5 screws) as follows:

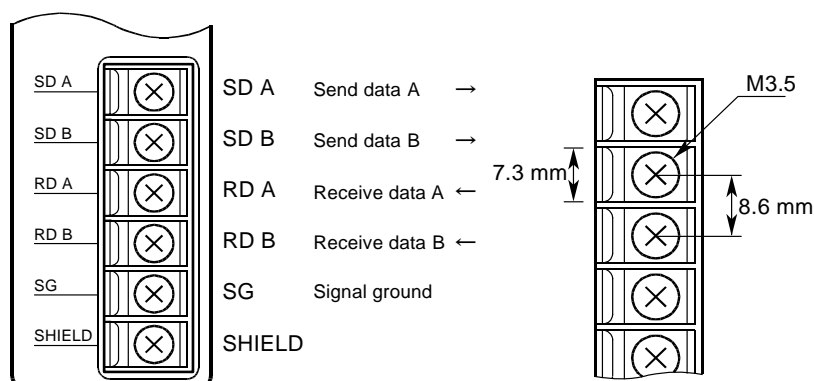


Figure B2.5 F3RZ91-0F Terminal Block

Table B2.1 Compatible Wires and Crimp-on Terminals

| | | | |
|---|---|-------------|---|
| Cable type | Shielded twist-pair cable | | |
| Rated temperature | 75°C or higher | | |
| Connection method | Using crimp-on terminals | | |
| Compatible crimp-on terminals and wires | Vendor | Model | Compatible Wire |
| | Japan Solderless Terminal Mfg Co., Ltd. | V1.25-M3 | AWG22 to 18 (0.33 to 0.82 mm ²) (copper wire) |
| | Nippon Tanshi Co., Ltd. | RAV1.25-3.5 | |
| | Japan Solderless Terminal Mfg Co., Ltd. | V1.25-M4 | |
| | Japan Solderless Terminal Mfg Co., Ltd. | V2-M4 | AWG16 to 14 (1.3 to 2.1 mm ²) (copper wire) |
| Tightening torque | 0.8 N·m (7.1 lbf·in) | | |

■ Connecting Master and Slave

● 4-wire system

Supposing the F3RZ91-0F is a master, send and receive lines must be crossed between the F3RZ91-0F and the slave equipment.

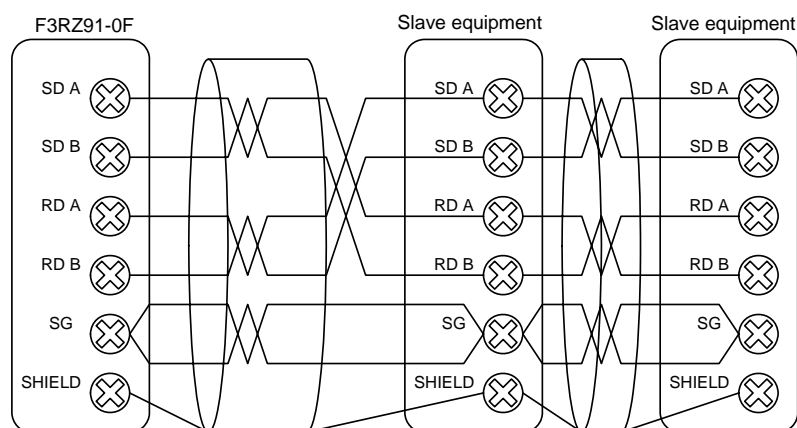


Figure B2.6 4-wire System Connection

● 2-wire system

At the F3RZ91-0F terminal block, short SD A with RD A, and SD B with RD B, using a jumper wire.

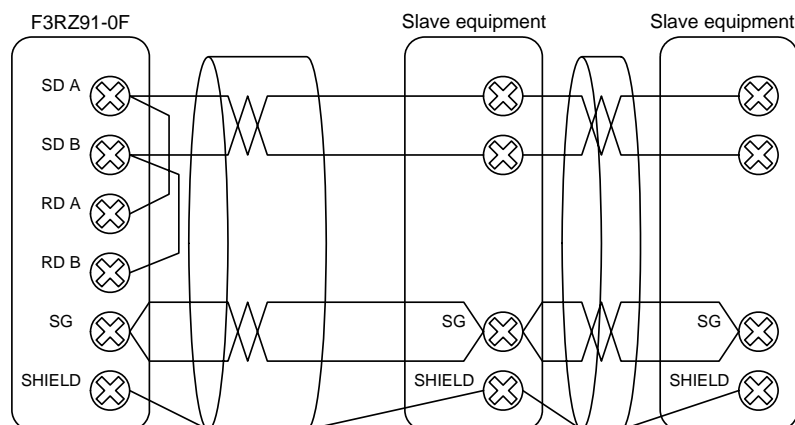


Figure B2.7 2-wire System Connection



CAUTION

If the 2-wire system connection is used, also set the 2-wire/4-wire selection parameter (data position No.: 918) of the communications mode area to 2-wire.

■ Terminating Resistor

If the F3RZ91-0F is at one end of the communication line, it must use the internal terminating resistor, or terminator, according to the wiring system used.

Set the terminating resistor switch to 4-WIRE for 4-wire system, or 2-WIRE for 2-wire system. Set the switch to OFF if the F3RZ91-0F is not at an end of the line.

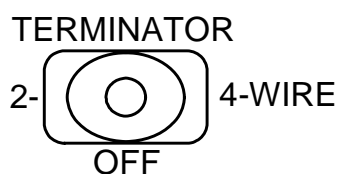


Figure B2.8 F3RZ91-0F Terminating Resistor Switch

B2.4 Attaching/Detaching the Module

■ Attaching the Module

Figure B2.9 shows how to attach this module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module. Push the top of the module toward the base module until the anchor/release button (yellow button) clicks into place.



CAUTION

Always switch off the power before attaching or detaching the module.

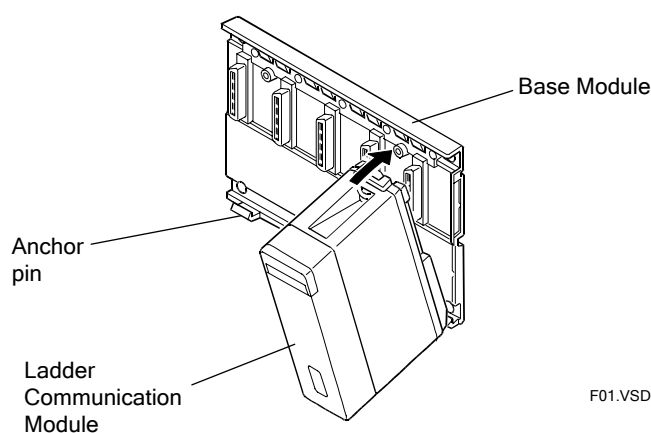


Figure B2.9 Attaching/Detaching the Module



CAUTION

Do not bend the connector on the rear of the module by force during the above operation. If the module is pushed with improper force, the connector may bend, causing an error.

■ Detaching the Module

To remove this module from the base module, reverse the above operation.

Press the anchor/release button (yellow button) on the top of this module to unlock it and tilt the module away from the base module.

■ Attaching the Module in Intense Vibration Environments

If the module is used in intense vibration environments, fasten the module with a screw.

Use screws of type listed in the table below.

Insert these screws into the screw holes on top of the module and tighten them with a Phillips screwdriver.

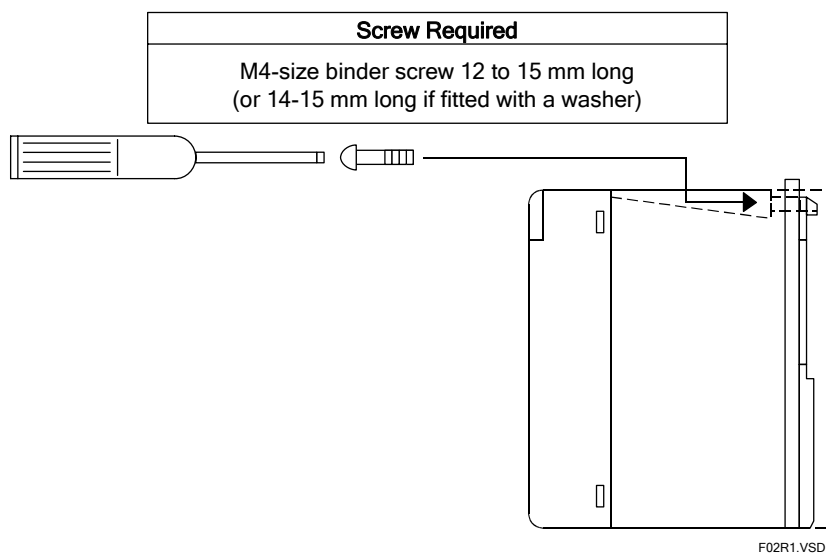


Figure B2.10 Securing Module Using Screws

B3. List of I/O Relays

The ladder communication module has 32 input and 32 output relays for interfacing with the FA-M3 CPU module. Each of the input relays can be configured to raise an interrupt.

B3.1 Output Relays

Table B3.1 Output Relays

| Output Relay Number | Output Relay Name | Description |
|---------------------|--|---|
| Y□□□33 | Read Received Data Completed | Turn on this relay after reading data from the receive data area. Turning on this relay turns off X□□□01 (receive completed normally) and X□□□07 (receive error), and the module is ready to receive new data into the receive data area. |
| Y□□□34 | Request to Send | Turn on this relay after having stored send data size and send data to the registers. If data is sent successfully following this request, X□□□02 turns on, and if an error occurs, X□□□08 turns on. |
| Y□□□35 | Request to Set Communications Mode | Turn on this relay after having stored communications mode setting in the communications mode area. If setup is successful following this request, X□□□03 turns on, and if an error occurs, X□□□09 turns on. |
| Y□□□36 | Request to Read Communications Mode Status | Turn on this relay to read the contents of the communications mode area and the control line status. If the request is completed successfully, X□□□04 turns on. |
| Y□□□37 | Request to Initialize Receive Buffer | Turn on this relay to initialize the receive buffer and the communications controller. X□□□05 turns on after successful initialization. |
| Y□□□38 | Request to Send Break | Turn on this relay to send a break signal. If a break is sent successfully following this request, X□□□06 turns on, and if an error occurs, X□□□08 turns on. |
| Y□□□39 to Y□□□64 | Reserved | |

B3.2 Input Relays

Table B3.2 Input Relays

| Input Relay Number | Input Relay Name | Description |
|---------------------|---|---|
| X□□□01 | Receive Completed | This relay turns on when received data is transferred from the receive buffer to the receive data area. Turning on Y□□□33 turns off this relay. |
| X□□□02 | Send Completed | This relay turns on when data is successfully sent following a request to send. Turning off Y□□□34 turns off this relay. |
| X□□□03 | Set Communications Mode Completed | This relay turns on when a request to set communications mode is successfully completed. Turning off Y□□□35 turns off this relay. |
| X□□□04 | Read Communications Mode Status Completed | This relay turns on when the communications mode status has been successfully read out and stored. Turning off Y□□□36 turns off this relay. |
| X□□□05 | Initialize Receive Buffer Completed | This relay turns on when the receive buffer and the communications controller have been successfully initialized. Turning off Y□□□37 turns off this relay. |
| X□□□06 | Send Break Completed | This relay turns on when a break signal has been sent successfully. Turning off Y□□□38 turns off this relay. |
| X□□□07 | Receive Error | This relay turns on if error is detected during data receiving. Turning on Y□□□33 turns off this relay. |
| X□□□08 | Send Error | This relay turns on if error is detected when processing a request to send or a request to send break. Turning off Y□□□34 or Y□□□38 turns off this relay. |
| X□□□09 | Set Communications Mode Error | This relay turns on if error is detected during communications mode setup. Turning off Y□□□35 turns off this relay. |
| X□□□10 to X□□□32 | Reserved | |

B4. List of Data Areas

The ladder communication module has send and receive data areas and communications mode areas for interfacing with the FA-M3 CPU module. The communications mode areas are used to store communications mode settings, and the send and receive data areas are used to store data to be sent and data received respectively.

Data Position No.

| | | |
|-----|--------------------------|----------|
| 1 | Send data area | (port 1) |
| 384 | | |
| 385 | Receive data area | (port 1) |
| 896 | | |
| 897 | Send data byte count | (port 1) |
| 898 | Send status | (port 1) |
| 899 | Receive data status | (port 1) |
| 900 | Receive data byte count | (port 1) |
| 905 | Communications mode area | (port 1) |
| 968 | | |



CAUTION

- You may customize the send data area size and receive data area size to use data positions between 1 and 896.
- Data positions above 896 are fixed and cannot be customized.

B4.1 Communications Mode Areas

Data Position No.

| | | |
|-----|-------------|--------------------------|
| 905 | Setup area | Communications mode area |
| 936 | | |
| 937 | Status area | |
| 968 | | |

The communications mode area is divided into two sub-areas: setup area and status area. A user program writes communications mode settings to the setup area before issuing a request to set communications mode. It reads the status area to check the internal communications mode parameters of the module.

■ Communications Mode Setup Area

| Data Position No | Description ² | | Default |
|------------------|--|---|-----------------------|
| 905 | Character-to-character timeout processing | 0: receive successful; 1: receive error | 0 |
| 906 | Character length | 0: 7 bits; 1: 8 bits | *1 |
| 907 | Stop bits | 0: 1 bit; 1: 2 bits | *1 |
| 908 | Parity | 0: none; 1: odd; 2: even | *1 |
| 909 | Transmission speed (in bps) | 0: 300 7: 19200 1: 600 8: 28800 2: 1200 9: 38400 3: 2400 10: 57600 4: 4800 11: 76800 5: 9600 12: 115200 6: 14400 | *2 |
| 910 | Reserved | | |
| 911 | Break transmission interval | 1 to 32760 (ms) | 400 |
| 912 | Start character of receive text | <div> <div>15 8 7 0</div> <div>0 Start character</div> </div> - All 0's if no start character is used | 0 |
| 913 | End character (terminator) of receive text | <div> <div>15 8 7 0</div> <div>First terminator Second terminator</div> </div> - All 0's for the first terminator if only one end character is used. - All 0's for the first and second terminators if no end character is used. | \$0D · \$0A (CR · LF) |
| 914 | Receive text length | 0 to 1024 (number of characters on the line) ³ 0 means no receiving. | 1024 |
| 915 | Character-to-character timeout interval | 0 to 32760 (ms) 0 means not monitored | 1500 |
| 916 | Reserved | | |
| 917 | Reserved | | |
| 918 | 2-wire/4-wire selection | 0 for 4-wire system, 1 for 2-wire system | 0 |
| 919 to 934 | Reserved | | |
| 935 | Send data area size (port 1) | - In units of words | 384 |
| 936 | Receive data area size (port 1) | - Total size for send and receive data areas must not exceed 896 words (1792 bytes) | 512 |

*1: The default value is set with the SW2 switch.

*2: The default value is set with the SW1 switch.

*3: Depends on receive data area size.



CAUTION

Both the break transmission interval and receive character-to-character timeout interval have an error of 1 ms so the actual duration may be up to 1 ms shorter than the specified value.

■ Communications Mode Status Area

| Data Position No | Description | |
|------------------|--|---|
| 937 | Character-to-character timeout processing | 0: receive successful 1: receive error |
| 938 | Character length | 0: 7 bits; 1: 8 bits |
| 939 | Stop bits | 0: 1 bit; 1: 2 bits |
| 940 | Parity | 0: none; 1: odd; 2: even |
| 941 | Transmission speed (in bps) | 0: 300 7 : 19200 1: 600 8 : 28800 2: 1200 9 : 38400 3: 2400 10 : 57600 4: 4800 11 : 76800 5: 9600 12 : 115200 6: 14400 |
| 942 | Reserved | |
| 943 | Break transmission interval | 1 to 32760 (ms) |
| 944 | Start character of receive text | <div style="text-align: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> 15870 </div> <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> 0Start character </div> </div> • All 0's if no start character is used |
| 945 | End character (terminator) of receive text | <div style="text-align: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> 15870 </div> <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> First terminatorSecond terminator </div> </div> • All 0's for the first terminator if only one end character is used • All 0's for the first and second terminators if no end character is used |
| 946 | Receive text length | 0 to 1024 (number of characters on the line) ³ 0 means no receiving |
| 947 | Character-to-character timeout interval | 0 to 32760 (ms); 0 means not monitored |
| 948 | Reserved | |
| 949 | | |
| 950 | 2-wire/4-wire selection | 0 for 4-wire system, 1 for 2-wire system |
| 951-964 | Reserved | |
| 965 | Send data area size | |
| 966 | Receive data area size | |
| 967 | Reserved | |
| 968 | Setup error information | <div style="text-align: center;"> <div style="display: flex; justify-content: space-between; width: 100%;"> 15870 </div> <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: center;"> Data position no. </div> </div> |

● Character-to-character timeout processing

Character-to-character receive timeout is always monitored. When timeout occurs, it is considered either a receive error (the Receive Error input relay turns on) or the normal completion of receive data (the Receive Completed input relay turns on) according to this setting.

If this setting is 0, a character-to-character receive timeout is always considered the normal completion of receive data and the Receive Completed input relay turns on. This setting is useful when the receive text length or the end character cannot be specified. When a character-to-character receive timeout occurs, the character-to-character receive timeout bit of the Receive data Status register turns on irrespective of this setting.

● Character length

This setting is used to specify how many bits make up one character.

● Stop bits

This setting is used to specify how many bits are used to signify the end of a character.

● Parity

This setting is used to define the parity bit, which is used for error detection.

- **Transmission speed**

This setting is used to specify the transmission speed.

- **Break transmission interval**

This setting is used to specify the duration of a break signal. It cannot be set to 0 ms.

- **Start character of receive text**

This setting is used to define the start character that signifies the beginning of receive text. No start character is attached to send text.

- **End character of receive text**

This setting is used to define the end character that signifies the end of receive text. No end character is attached to send text.

- **Receive text length**

This setting is used to specify the number of characters for delimiting receive text. This setting may not exceed a user-defined receive data area size.



CAUTION

-
- If the receive text length is set to a value larger than the receive data area size, the receive data area size is used. If the receive text length is set to a value larger than 1792, however, a Set Communications Mode Error is generated.
 - The receive text length is ignored if the receive data area size is set to 0.
 - If the receive text length is set to 0, the module can receive no data.
-

- **Character-to-character timeout interval**

This setting is used to define the character-to-character receive timeout interval, which is the maximum allowable lapse between two successive characters in the same text. When a timeout occurs, whether it is considered a receive error or the normal completion of receive text depends on the character-to-character timeout processing setting.

- **Send data area size, receive data area size**

Use these settings to specify the size of the send and receive data areas respectively.

A total space of 896 words (1792 bytes) may be freely shared among the send and receive data areas. Specify the size in word (two bytes) units.



CAUTION

-
- A send error is generated if the send data area size of a port is set to 0, but a request to send is issued for that port.
 - If the receive data area size of a port is set to 0, it will not be available for receiving.
 - Do not change the setting of the send data area size or the receive data area size during communication.
 - If the setting of the send or receive data area size is changed during communication, beware that there may be old data remaining in the data areas.
-

B4.2 Send and Receive Data Areas

● Allocation of send and receive data areas

| | |
|-------------------|-----------------------------------|
| Data position No. | |
| 1 | Send data area (port 1) |
| 384 | |
| 385 | Receive data area (port 1) |
| 896 | |
| 897 | Send data byte count (port 1) |
| 898 | Send status (port 1) |
| 899 | Receive data status (port 1) |
| 900 | Receive data byte count (port 1) |
| 905 | |
| 968 | Communications mode area (port 1) |



CAUTION

- You may customize the send data area size and receive data area size for using data positions between 1 and 896.
- Data positions above 896 are fixed and cannot be customized.

● Send data area

This area is used to store data to be sent.

● Receive data area

This area is used to store data received.

● Send data byte count

This area is used to store the number of bytes to be sent. Following a request to send, data is sent until the specified number of bytes is reached.

● Send status

This area is used to store the completion status after transmission.

| Status | Error Code (Decimal) | Description |
|----------------------|----------------------|-------------|
| Send successful | 0000 | |
| Send data size error | 0100 | |

● Receive data status

This area stores the status of the received text stored in the receive data area. The status is a combination of error bits (see the table below). An error bit is turned on if the corresponding error is detected for any byte of the received text. If an error bit is turned on, there is no way to tell which byte is the cause.

| 15 to 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|----------|------|-----|-----|------|------|-------|
| Reserved | ORER | FER | PER | IBOF | RCTO | BREAK |

ORER : Overrun error

FER : Framing error

PER : Parity error

IBOF : Receive buffer overflow

RCTO : Character-to-character receive timeout

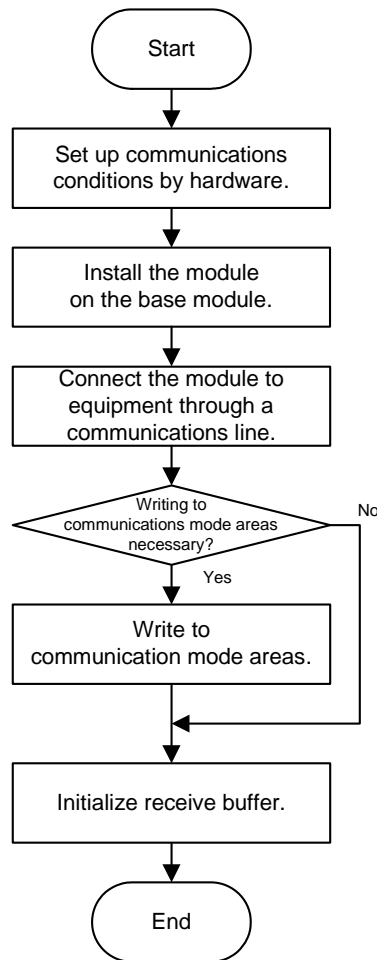
BREAK : Break signal received

● Receive data byte count

This area stores the number of bytes of data received. By reading the value stored in this area, a program can determine the size of received data. The end character in received data is automatically deleted when the received data is stored in the receive data area.

B5. Startup Preparation

The flowchart below shows the things to be done to prepare for communications.



See Also:

Set the module and the remote equipment with the same communications conditions.

B2.2, "Switch Setup"

B2.4, "Attaching/detaching the Module"

B2.3, "External Wiring"

Not necessary if the settings with the switches on the side of the module are used as they are.

B3, "List of I/O Relays"

B4.1, "Communications Mode Areas"

B7.1, "Communications Mode Areas"

The receive buffer should be initialized to discard any unwanted data due to electric noise that may be present on the communications line.

B7.2, "Initializing Receive Buffer"

B6. Data Communications

B6.1 Format of Received Text

The F3RZ91-0F ladder communication module may recognize a block of received text by any of the following three means:

- By receiving a terminator
- By receiving the number of characters designated by the Receive Text Length setting in the communications mode area
- By detecting a character-to-character receive timeout



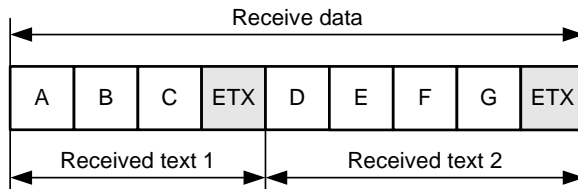
CAUTION

- A block of received text is recognized when any of the above three conditions is met.
- You may explicitly disable individual conditions if so desired.
- However, you may not disable the condition defined by the Receive Text Length setting.

● Receiving a terminator

A block of text is recognized when a terminator (end characters) is received. The default terminator is the CR-LF character pair.

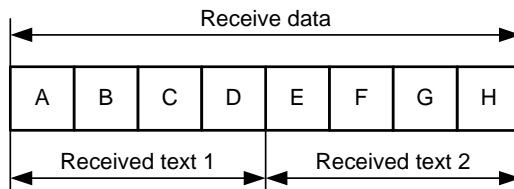
Example: If ETX (\$03) is used as a terminator



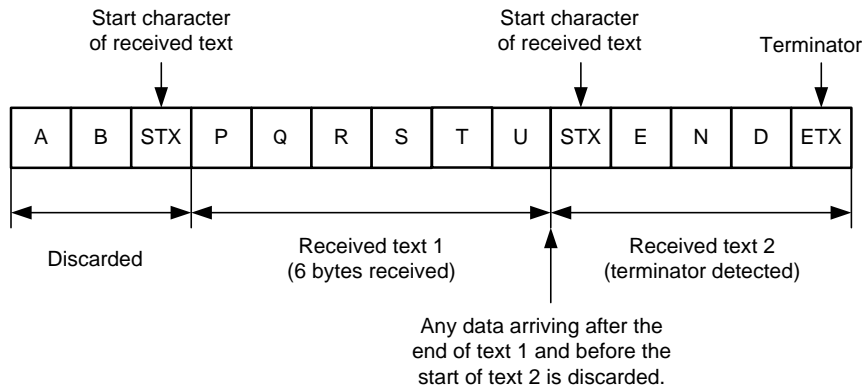
● Receive Text Length setting

A block of text is recognized when the number of bytes designated by the Receive Text Length setting (between 1 and 1024) is received. If a start character of receive text is specified, bytes for received text are counted starting from the character following the start character. The default value for the Receive Text Length setting is 1024 (bytes).

Example 1: Receive Text Length is set to 4 (bytes)



Example 2: Receive Text Length is set to 6 (bytes) with the use of start character STX (\$02) and terminator ETX (\$03)

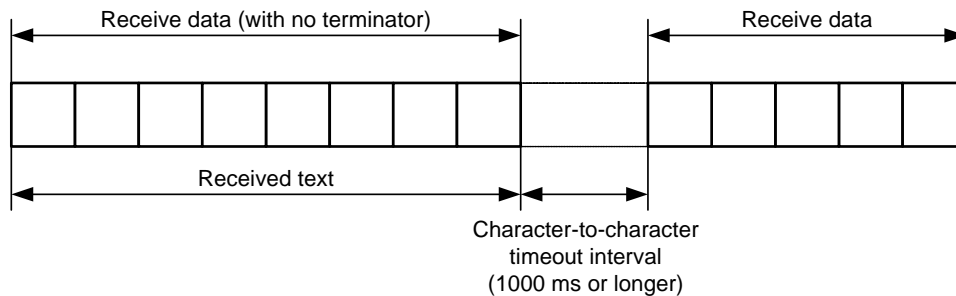


● **Detecting a character-to-character receive timeout**

A block of text is recognized when the next character is not received after a specified timeout interval. This is especially useful for receiving binary data or text with no terminator.

The default character-to-character timeout interval is 1500 ms

Example: Character-to-character timeout interval is set to 1000 ms and no terminator is used in receive data



When a character-to-character receive timeout occurs, it is either considered the normal end of received text as discussed above or a receive error depending on the Character-to-Character Timeout Processing setting.

B6.2 Break Signal

The break signal is a special signal consisting of all '1' bits, which is sent to generate a framing error. The ladder communication module is capable of sending a break signal, as well as recognizing a break signal.

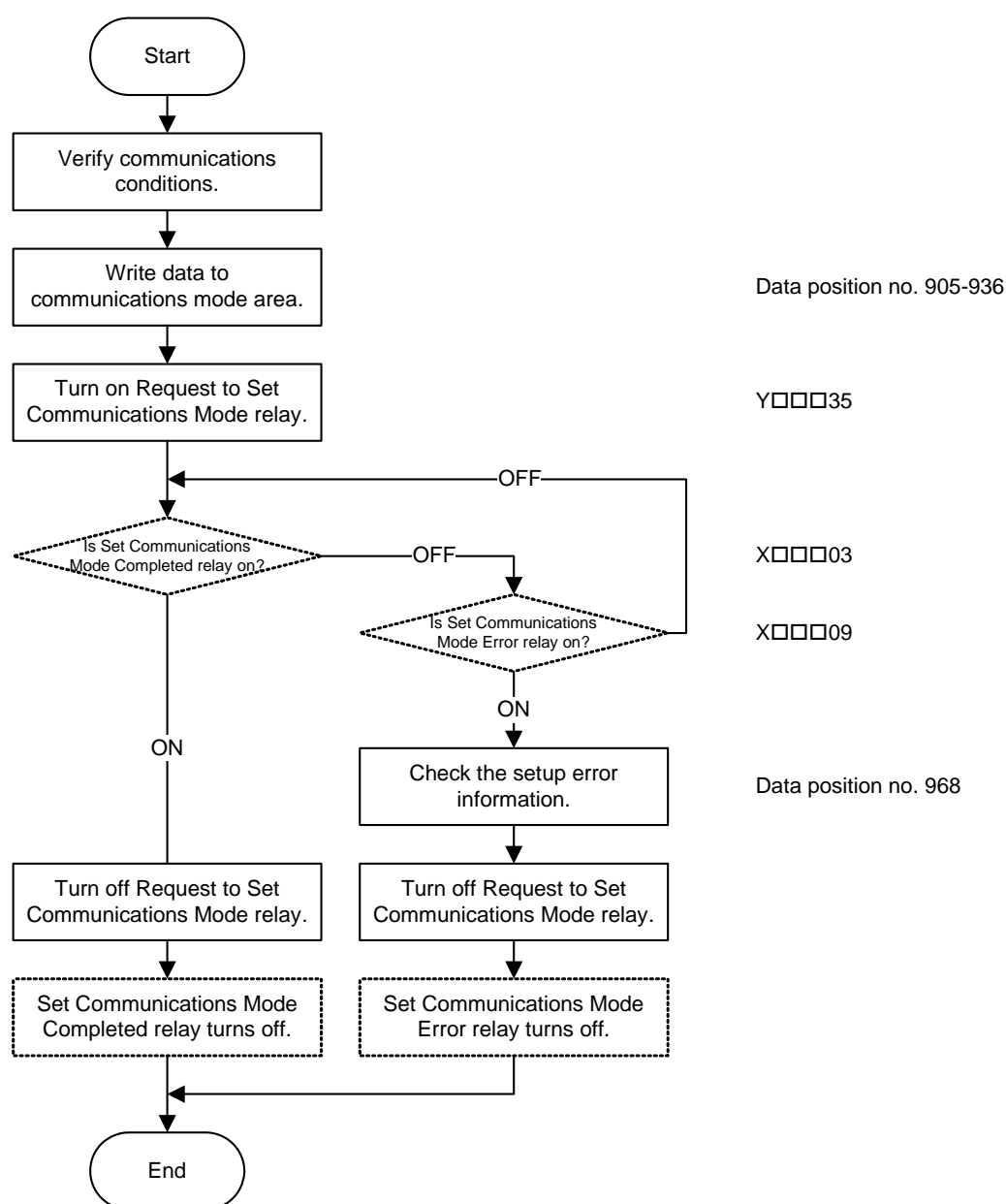
B7. Programming

B7.1 Communications Mode Areas

Before data can be sent to remote equipment, communications conditions must be set up. To support a variety of communications protocols, the F3RZ91-0F ladder communication module allows many functions to be configured using the communications mode areas.

For instance, while the transmission speed and the data format definition can be specified using the SW1 rotary switch and the SW2 DIP switch on the right side of the module respectively, they can also be set by software, by writing to the communications mode areas from the FA-M3 CPU module using a program. This means that the settings can be changed even after the ladder communication module is installed on the base unit.

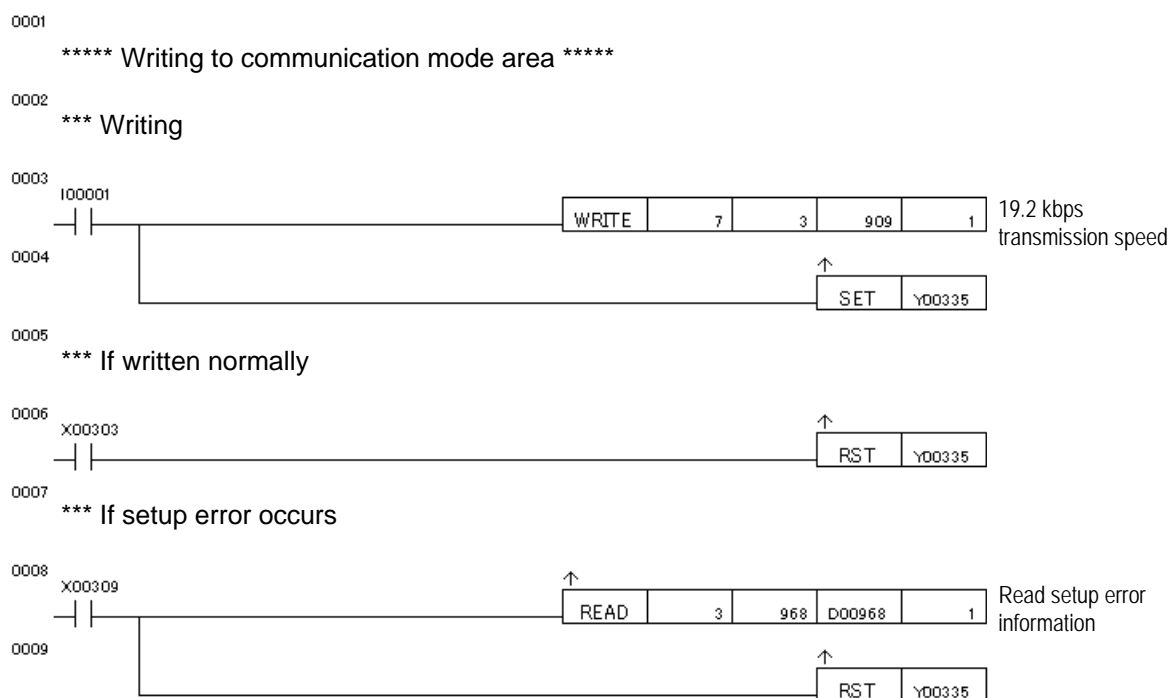
● Writing to communications mode area



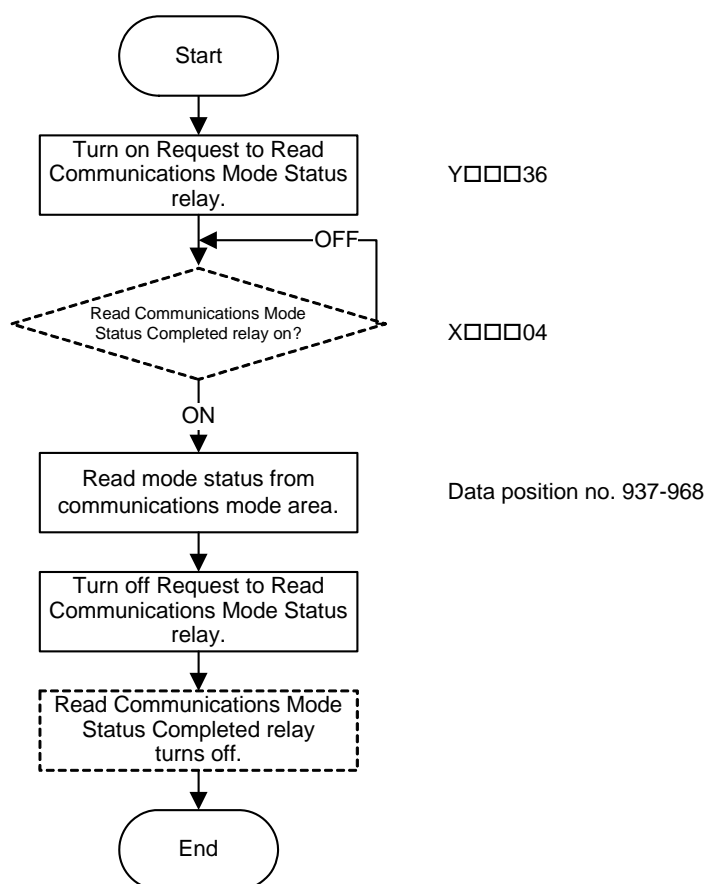
● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.
- Transmission speed is 19200 bps.



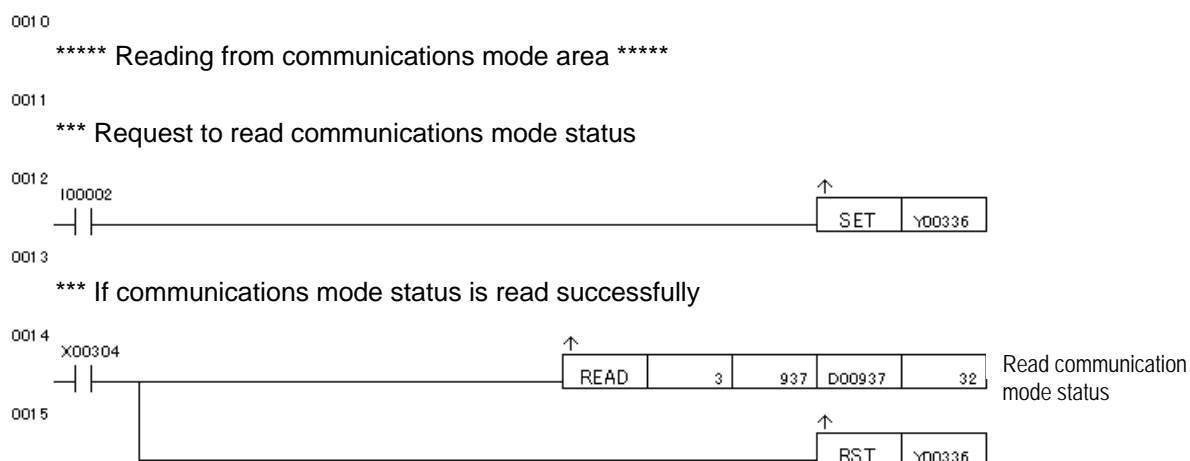
● Reading from communications mode area



● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.
- All the contents of the communications mode area for port 1 are to be read.



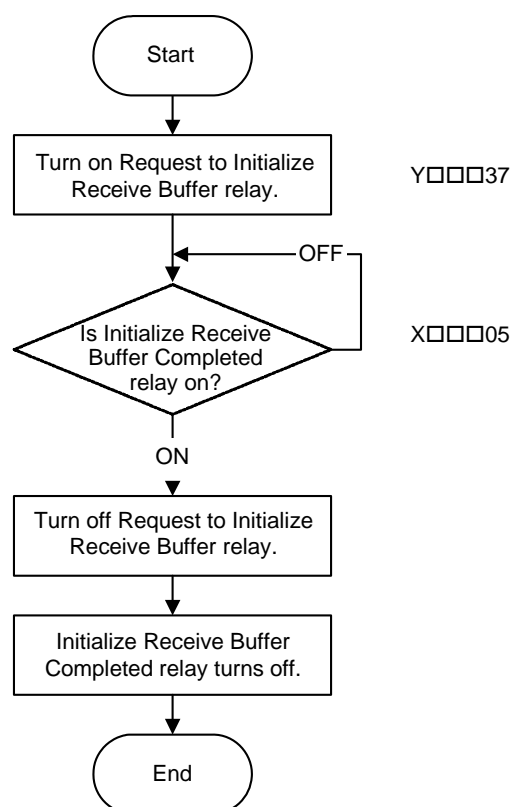
B7.2 Initializing Receive Buffer

When the module establishes connection with a remote device or when a remote device is switched on, noise (or unwanted data) may arise and propagate through the communications line. To avoid receiving unwanted data inadvertently, it is advisable to initialize the receive buffer before starting communications, in addition to setting up the communications conditions.

The receive buffer initialization function performs the following actions:

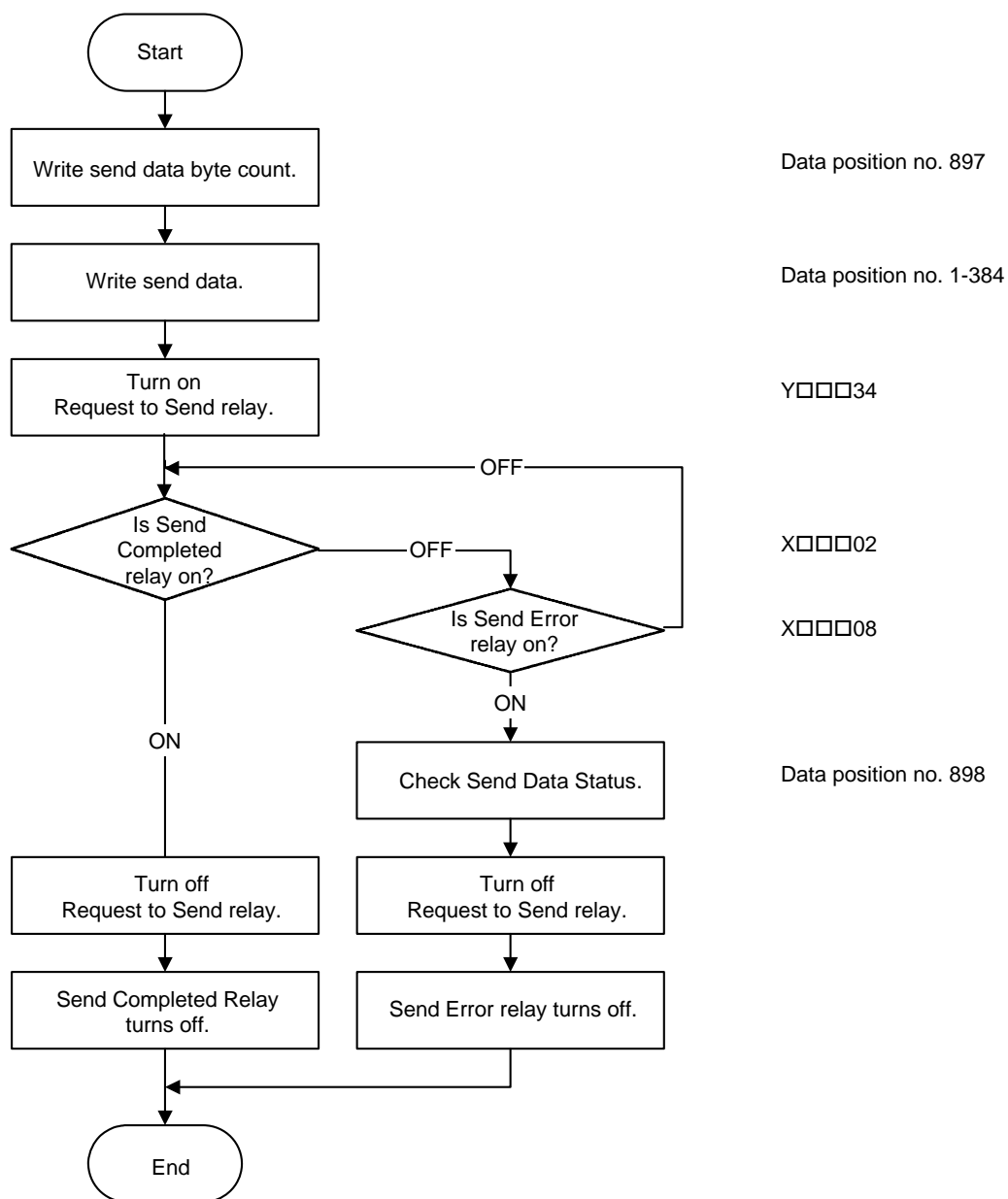
- Clears the receive buffer (rotary buffer). Beware that the receive data area is different from the receive buffer and is not initialized by this function.
- Resets the communications controller.

● Initializing receive buffer



B7.3 Sending Data

● Send procedure



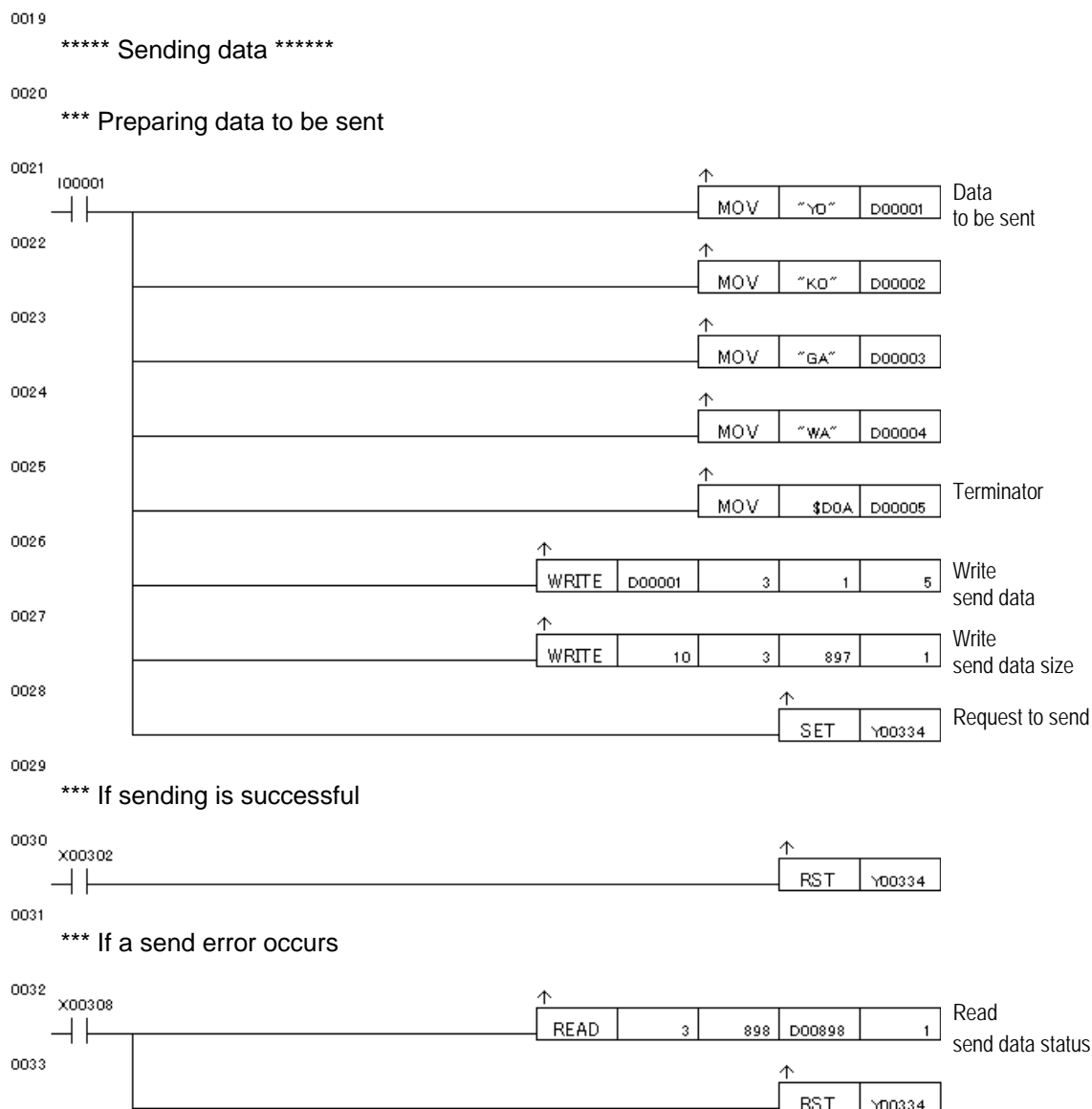
CAUTION

- This procedure assumes that default data position numbers are used for the send data area.
- The data position numbers will be different if the size of the send or receive data area is redefined by a user.

● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.
- Text to be sent is "YOKOGAWA ".
- End characters are a pair of CR and LF (\$0D and \$0A) characters.

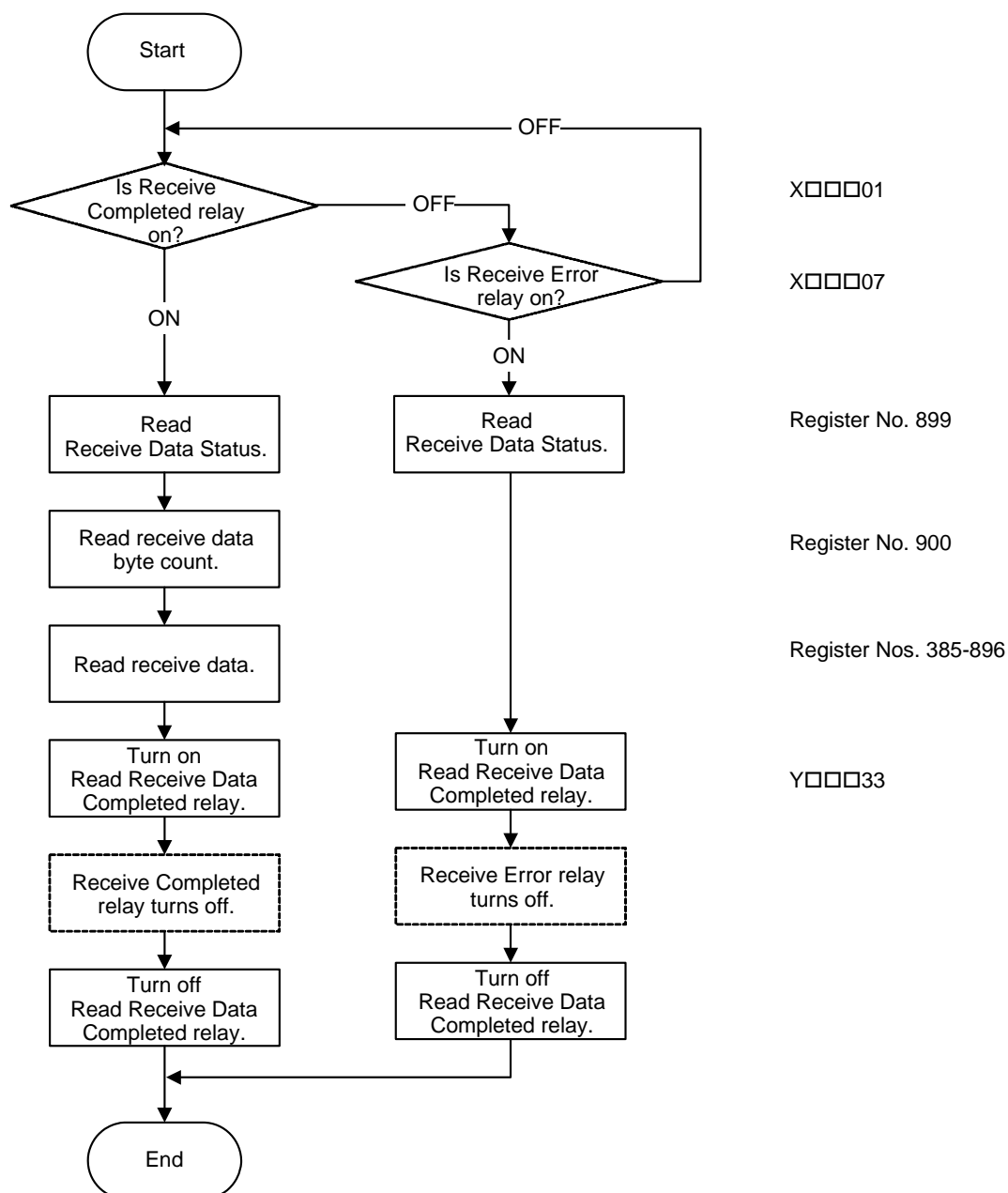


CAUTION

The character string input function used to store send data is only supported for F3SP28, 38, 53, 58, and 59-□N/□H/□F CPU modules.

B7.4 Receiving Data

● Receive procedure



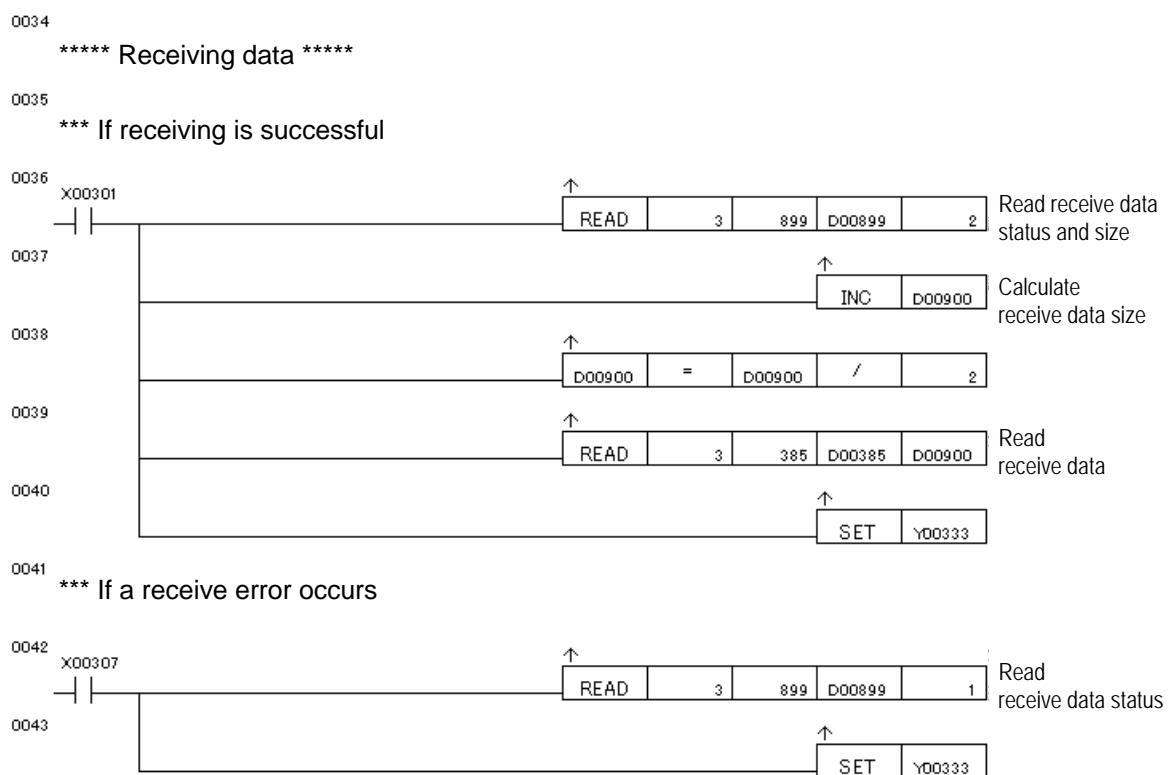
CAUTION

- This procedure assumes that default data position numbers are used for the receive data area.
- The data position numbers will be different if the size of the send or receive data area is re-defined by a user.

● Sample program

This sample program assumes the following conditions:

- The module is installed in slot 3.

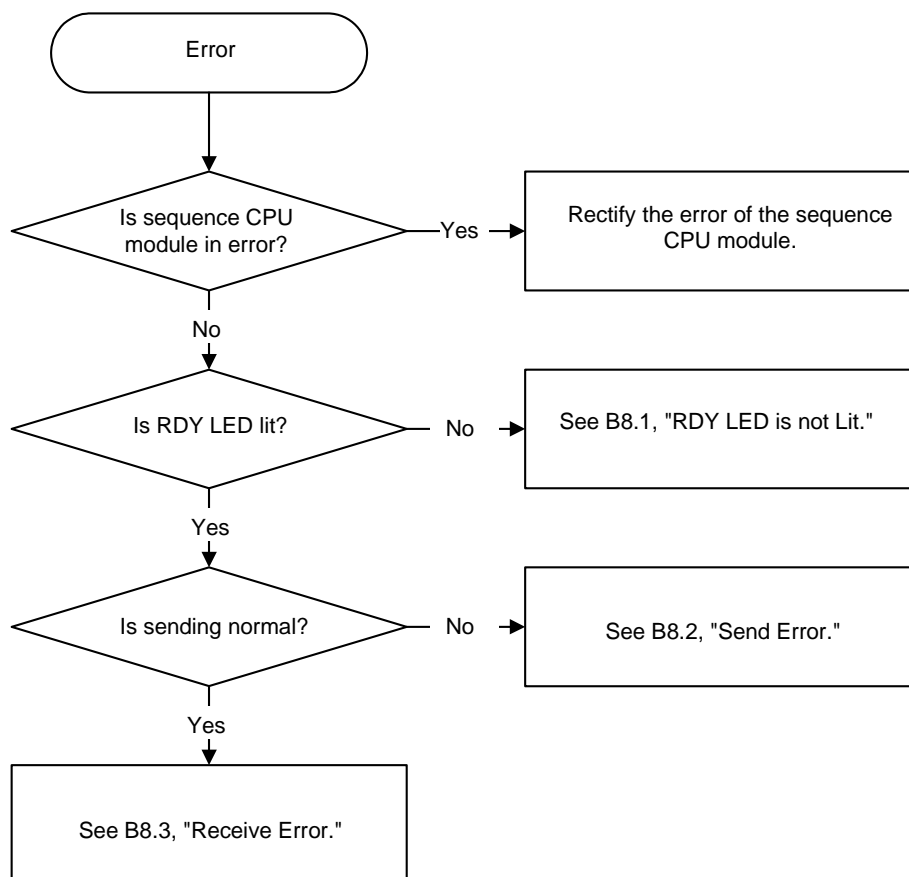


CAUTION

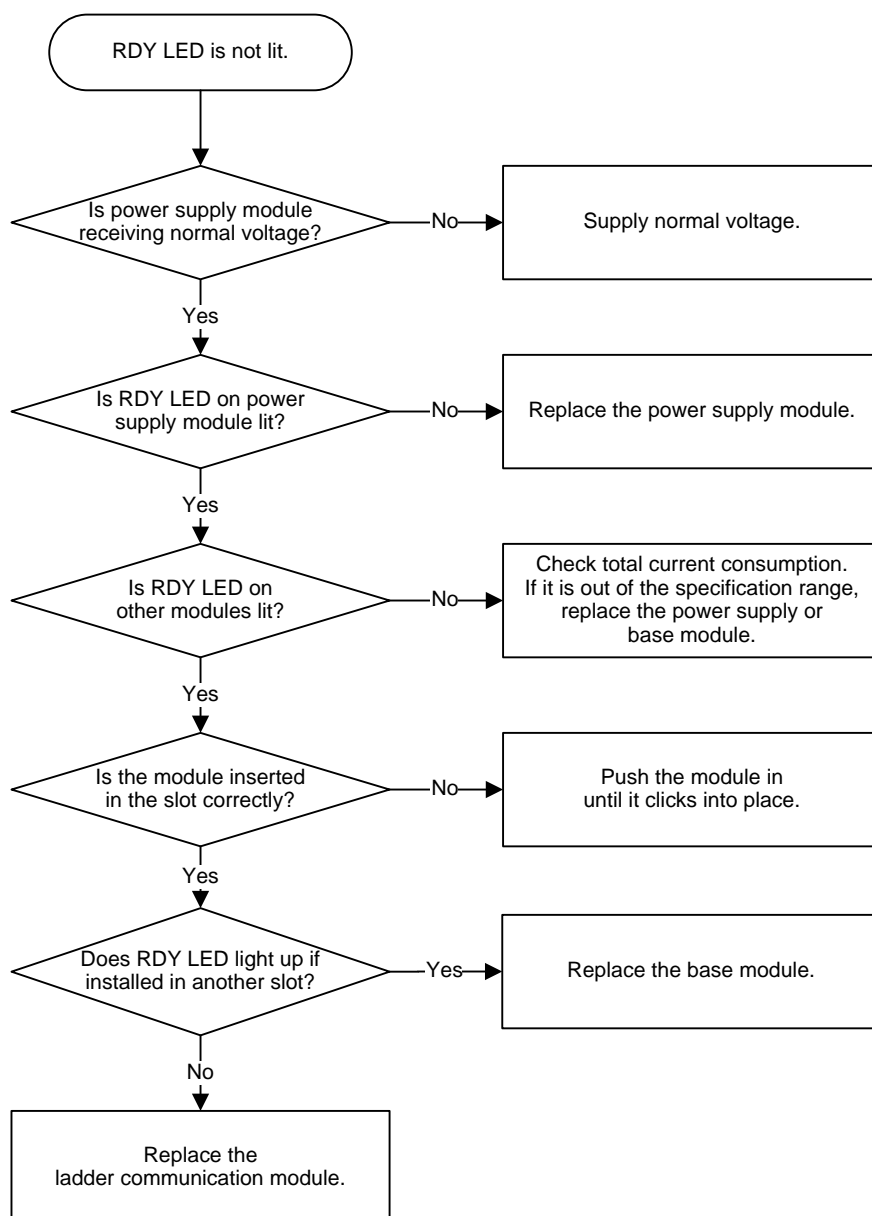
The receive data size is stored in units of bytes in the module. You must convert the size in bytes into size in words when reading the received data into the CPU module using the READ instruction.

B8. Troubleshooting

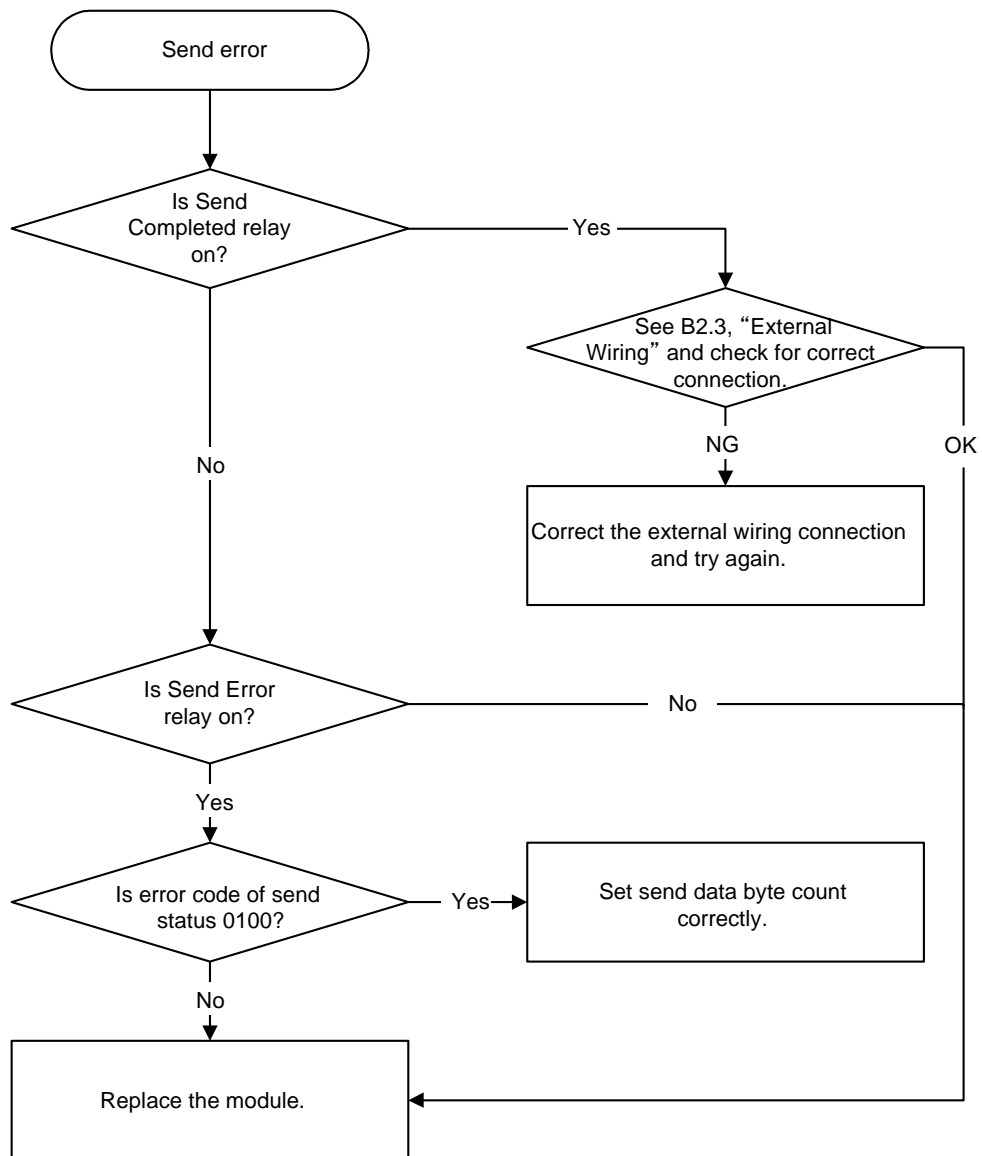
These are troubleshooting flowcharts for common errors involving the module.



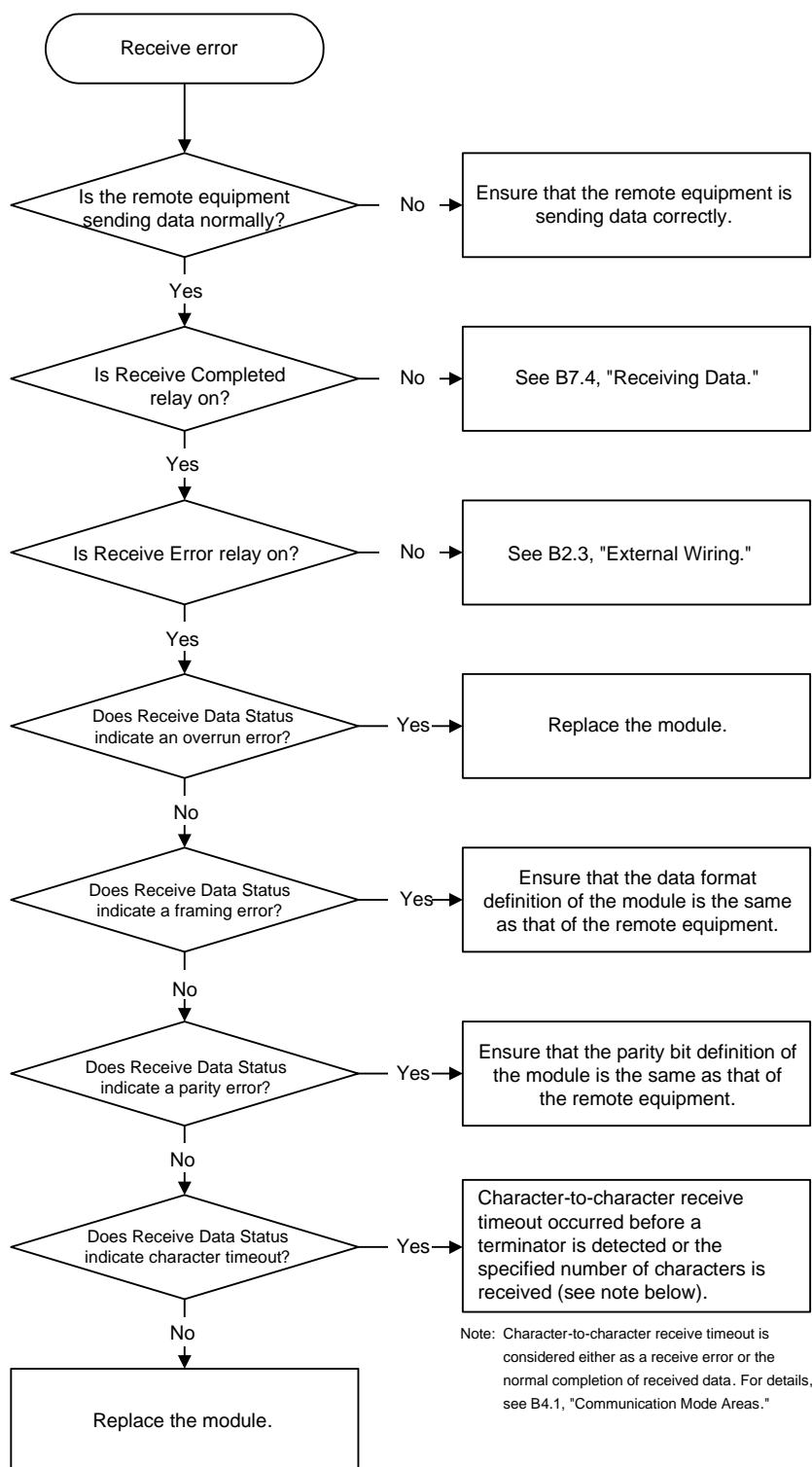
B8.1 RDY LED is not Lit



B8.2 Send Failure



B8.3 Receive Failure



Appendix B1. ASCII Code Table

| High Low | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-------------|-----|-----|----|---|---|---|---|-----|
| 0 | NUL | DLE | SP | 0 | @ | P | ` | p |
| 1 | SOH | DC1 | ! | 1 | A | Q | A | q |
| 2 | STX | DC2 | " | 2 | B | R | B | r |
| 3 | ETX | DC3 | # | 3 | C | S | C | s |
| 4 | EOT | DC4 | \$ | 4 | D | T | D | t |
| 5 | ENQ | NAK | % | 5 | E | U | E | u |
| 6 | ACK | SYN | & | 6 | F | V | F | v |
| 7 | BEL | ETB | ' | 7 | G | W | g | w |
| 8 | BS | CAN | (| 8 | H | X | h | x |
| 9 | HT | EM |) | 9 | I | Y | i | y |
| A | LF | SUB | * | : | J | Z | j | z |
| B | VT | ESC | + | ; | K | [| k | { |
| C | FF | FS | , | < | L | ¥ | l | |
| D | CR | GS | - | = | M |] | m | } |
| E | SO | RS | . | > | N | ^ | n | ~ |
| F | SI | US | / | ? | O | _ | o | DEL |

FA-M3**Ladder Communication Module****Part B: F3RZ91-0F**

IM 34M6H22-02E 2nd Edition

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